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## FEATURES

### TRAINS OF TOMORROW

Ecological issues may bring about a worldwide railroad revival

14

### SEA CITY

Will human-made islands of concrete and glass save the world from doomsday?

18

### THE PAYOFF FROM SPACE

Technology developed for the space program is improving life on Earth

26

### FARSIDE

The other side of the Moon offers a bird's eye view of the universe

30

### FLASH GORDON RETURNS

An old hero becomes a new star in a \$40 million space opera

32

### THE BRITISH CONNECTION

Some of American TV's finest science shows are made in-England

34

### STEEL COUTURE

Artist Syd Mead shapes the future

47

### THE 1980'S: A BACKWARD GLANCE

A new book recalls the 1980s—a decade screwier than the '70s

50

### BERNIE KRAUSE: ELECTRONIC PIONEER

A synthesizer pioneer evaluates his career

52

### ASIMOV AT 60

SF's favorite birthday boy ponders his past and looks forward to his future

54

## DEPARTMENTS

### OUTPUT

A message from the Publisher

5

### INPUT

Letters from our Readers

6

### DATABANK

Magazines that talk back, SF promoters who are hacks, SF films based on science fact

9

### EARTH CONTROL

Forests: Seeing them for the trees

23

### GYLL

Barclay Shaw offers surrealist fantasy

37

### VIDEO IMAGES

Buck Rogers' 25th century style

40

### ALTERNATE SPACE

Here come the spaceburgers!

43

### IN PRINT

Book news and reviews

44

### PORTFOLIO

The inventor of the word "spacescape" shows how it's done

58

### TOMORROW

Charles Sheffield offers 10 surprising predictions for the future

70

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## Primitive Force

**B**asically I'm an optimist. Not a blind, foolish, sugar-coated optimist but a mature, realistic optimist. I am certain that in the long run humanity will become more and more rational, improving the physical existence and happiness quotient of all individuals.

At some indefinite point in the future of life on this planet, I foresee a human race that has left behind all gross irrationalities and is happily engaged in creative, productive enterprises. There will still be problems—both personal and social—but the problems will be reasonable and legitimate, and the methods of settlement will be peaceful and intelligent.

In that world of the future—cleaner and saner—I can envision a youngster, having just discovered some of the history of Earth, approaching his father with puzzlement on his bright young face:

“Dad, is it true that in ancient times the rulers used to force women to have babies, even if they didn't want to?”

“I know it's hard to believe, son, but there were actually *laws* that said if a woman got pregnant by accident and didn't want to have a baby, the government could take her to court, fine her, and even throw her in prison in order to force her to give birth!”

“Why? Did they *need more people*?”

“No, son—quite the opposite.”

“But didn't some of the moral leaders—professors or philosophers—speak up and say that the laws were *evil*?!”

“In those days, they had religious leaders who guided most people on moral issues, and most of them agreed that women who became pregnant should pay for their sin by being forced to give birth.”

“Do you mean they thought getting pregnant was a religious *sin*?!”

“Well, son, not as long as a woman was married and had sex strictly for the purpose of conceiving—but you see there were a lot of crazy notions about sex in primitive times. Most people felt guilty about sex unless it was in the approved manner and for the approved purpose.”

“But there is *no* approved manner for sex . . .”

“Not today. We have sex for pleasure and to toast a relationship between two people. But in ancient times, the moral leaders didn't approve of sex outside of marriage or between two people of the same sex or when the ages were quite different or when the motive was just plain fun. Son, I know these ideas sound silly to you, but I'm not making them up.”

“I don't understand why they were so concerned about other people's sex activities.”

“You know that sex is the most intense psycho-somatic pleasure a human can experience. In fact, it is one of life's greatest rewards for being alive and being human. For some reason, our ancestors thought that almost everything that made life difficult and painful was *good*—and everything that made life fun and enjoyable was *bad*. ”

“Everything? Not just sex?”

“There were times when people were told what foods to eat and when; they were told what magazines and movies they should not see; they were told that dancing and drinking were evil; at one time religious leaders prevented pain killers from being used in hospitals because they claimed science should not interfere with the suffering God sent to man.”

“But why did the government rulers *force* people to abide by these insane ideas?”

“Because throughout most of its pre-rational history, the human race accepted the idea that *some* people have the right to force ways of living on *other* people—just as long as they justified the force by saying it was for society's good—and as long as they were in control of the *guns* that made force possible.”

“Are there still people around *today* who want to control other people, Dad?”

“Yes, son—there probably always will be. That's one of the constant challenges of society—to allow those people to live their lives in peace and freedom while not allowing them the means to interfere with the way other people choose to live their lives.

Accomplishing *that* is one of the most important ingredients of a rational world.”

Kerry O'Quinn/Publisher

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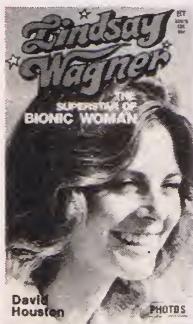
**ON THE COVER:** Sea City, an industrial complex and functioning community, is envisioned by artist David Mattingly. In the future, such human-built habitats in the oceans may contribute to solving many of our energy and food supply problems. For the story of this ambitious proposal, see page 18.

**ON THE CONTENTS PAGE:** The Milky Way as it might appear from an Earthlike planet some 200 thousand light years away, portrayed by acclaimed artist Don Dixon. For more of Dixon's spacescapes, turn to Portfolio on page 58.

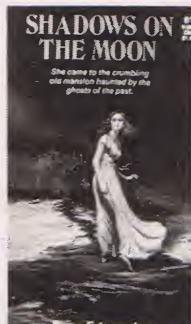
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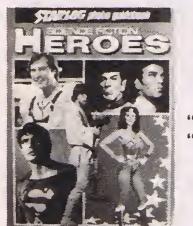
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# input

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## MOON TREATY DEBATE

... In Carolyn Henson's column (FUTURE LIFE #16), she made an extremely important point and it cannot be taken lightly. If the UN votes that the entire world jointly owns each stellar body, this will stifle space exploration for the next hundred years! Much of the humanization of space will be accomplished with the commercializing of outer space. With big business building small and eventually larger structures in space, the economic accessibility of space for the general public will go down (look at microprocessors—when the demand and usefulness went up, the price went down drastically). Big business will take this step, if they have an incentive. Economic solar power to sell and mine the Moon for its valuable minerals and other elements are just two of the many incentives. If, however, the UN treaty is signed, so that the profits from space must be divided up to all the nations, no companies will be interested and therefore space will remain inaccessible to those who wish to leave the nest of Earth. We cannot depend on the government to develop space colonization, even if they wanted to (and it's quite obvious that they're not very interested), for the price will be in the billions of dollars, and no one individual country could afford that. Ah, you say, what if the countries decide to go together to foot the bill? That would be great! There's just one problem: It would take world peace (something that would be nice to have) and that will take a while. And I for one do not want to wait, not when the technology is right there being dangled in front of our noses like bait to tempt a starving animal. That's what we are, though; starving ourselves of the greatest challenge man has ever sought, the stars.

Alright, you say, you've run off at the mouth until becoming blue in the face, so what's your solution? I'm glad you asked. I have no desire to shut off the world from the beauty of space, that's the farthest thought from my mind. To encourage businesses to move into space we must give them a reason. If all the discoveries of minerals or other valuable materials are allowed to be exploited by the businesses, everyone gains. The businesses gain the good old \$, the people of Earth gain the new resources, and we would-be space migrants get the advantages of a commercialized space that has an economical way of getting and living there.

One of the main reasons the Soviet Union is in support of this bill is that because space colonization will cause their culture to fall apart. With people separated by such vast distances, and so many settlements on many of the asteroids, the Soviets cannot possibly have an ironclad rule over their people. In other words, the human race might truly be freed from the squabbles of countries and thus establish peace.

David Selwin  
London, Ont., Canada

... Man-oh-man! Is Carolyn Henson off-base with her opinions on "Homesteading the Solar System" (FUTURE LIFE #16).

It was common in colonial times for broadsides to be printed warning American colonists of the power and greed of the East India Company. Well, today there are at least 200 East India Companies referred to as American-based multinationals, all looking for their own island so that they can do business with whomsoever they please, avoid taxes, pay low wages and not be bothered with strikes. Imagine what happens when multinationals become interplanetary!

The purpose of the Moon Treaty is to franchise mining and industrial operations so that the Haves don't hog all the more while the Have-nots receive even less. If such legislation is not passed, then the soon-to-be interplanetary will sell to whomever gives them the best deal and L-5 will be a company town. Ever think of those lovely Space Cities as company towns? Well, that's what they might well become unless there is UN control. Henson's confiscation fairy tale is a powder puff scenario compared to the horrors of space controlled by the sovereign spatial states of ITT and others.

And what's this about flying off to Mars and the asteroids when the "space tug"—Orbital Transfer Vehicle—is still unfunded? It seems to me that we should worry about maintaining things in the cis-lunar backyard before shooting off in all directions. Readers with an inclination to write to congressmen, etc. should urge the funding of the "space tug."

The Russians are doing it the right way. They putter around in orbit and work on docking procedures; next thing you know it's a space station and a permanent manned facility on the Moon. That's the ticket—a permanent manned presence to grow on.

We have to establish ourselves in the area between Earth orbit and Moon orbit and forget about shooting off in all directions or there will be little for the astronauts to come home to. Maybe it's the Russians and maybe it's interplanetary corporations, but not to take a good look close up for the good of the entire world is to throw the future away.

John Robinson  
Schenectady, NY

Carolyn Henson replies: *I agree wholeheartedly with your concerns over multinational corporations and the lack of funding for the space tug. However, funding the space tug or signing away the civil liberties of space settlers will not do a darn thing to protect them from oppression. Under the terms of the Moon treaty, instead of being abused by some 200 multinational corporations, us settlers would be oppressed by one monolithic, authoritarian regime.*

*The proposed Moon treaty contains some good ideas and enticing rhetoric. But we don't have to buy its totalitarian provisions along with the good stuff. Those of us fighting the Moon treaty are demanding that the State Department send it back to the U.N. for renegotiation. Senator Frank Church (D-ID), chairman of the Foreign Relations Committee, and fellow committee members Jacob Javits (R-NY), Dick Stone (D-FL), S.I. Hayakawa (R-CA) and Richard Lugar (D-IN) have all come out in writing backing our demands. State Department insiders who are also battling this ill-considered treaty tell us that thanks to these Senators' opposition, President Carter has called an interagency review to advise him on whether or not he should sign it. We are told that Carter will make this decision May 1.*

Those of you who wish to pass on your opinions to Carter can write him at 1600 Pennsylvania Ave., Washington, DC 20500 or call his office at (202) 456-1414. Reach for the stars!

... Regarding Carolyn Henson's article "Homesteading the Solar System," (FUTURE LIFE #16) Ms. Henson, I am afraid, presumes! She speculates on ways to prevent violent confrontation between Earthside and the homesteaders, but can that be prevented? And, more importantly, should it be prevented? I think not, on both counts. Governments being what they are, they could never stand for people having real freedom. They would always reach out to dominate. Having left Mary with the troop ship lined up in the sights of the collision defence beams, the next word should be "fire!"

Now, I know the anti-violence wimps among us will wince at this, but the practical will realize that new frontiers are won, not with flower power, but with firepower! Anyone who won't fight for their freedom doesn't deserve any! And the only way space farmers and miners and factory workers can have freedom is to become independent of the Terran ground hogs.

William R. Carter, Jr.  
Greeneville, TN

... I have just finished reading the article on homesteading by Carolyn Henson (FUTURE LIFE #16). Her scenario is interesting but the good commander has forgotten his Earth laws.

First, by building and living in the farm unit the family becomes its inhabitants or "natives." As such they have rights that the commander must respect.

Second, if for some reason the above does not apply (ha!), the commander must take into consideration the fact that this family is a business and is protected by the appropriate laws. The "business" being the growing of food for export.

Give the case to Perry Mason and let him worry about it.

David J. Garman  
Trenton, Ont., Canada

... In the newest issue of FUTURE LIFE, I read an article about the United Nations drafting a new treaty on the peaceful uses of space for the future of mankind. This article, combined with the column by Carolyn Henson in the same issue, I found to be very upsetting. After discussing this with a friend of mine, who is a field officer for the United Nations, he also found it very upsetting. I asked him if he could help in any way. He said he would try to obtain a copy of the final draft of the proposed treaty.

We are going to read over it, and if all our suspicions are correct, then we are going to try to form a group to get our congressmen to vote against it.

Would you keep us, the science fact and fiction followers, informed by trying to get and keep up-to-date articles on this particular subject in your magazine?

Bob Davis  
Lake Charles, LA

## DIVERSITY FOREVER

... Timothy Leary quips that within 25 years we will have mini-worlds in space made up of just bisexual vegetarians, and other colonies made up of just Anita Bryant followers. His point is that space colonization makes the concept of species- and cultural-plurality not only more possible but

also more necessary than ever before in human history.

Which brings us to the subject of Carolyn Henson's Alternate Space in FUTURE LIFE #15 ("Choosing the Right Partner for the Future").

From where we sit, your version of the future appears to be a midwestern farmgirl's space-age version of "When I grow up I want to marry a rich and successful doctor." Do you, in fact, envision future space colonies as an extension of the suburbs for the white/middle-class/American/nuclear family/consumers?

Sociologists tell us that current American sexual mores and living practices are more diverse than ever before. More people are living singly than ever before. The extended family, the group-living arrangement—whether communal or not—the extended network or support group, and the "roommate" arrangement are all on the rise. Among those that do still pair-bond in the traditional manner, divorce and re-marriage are on the rise, which means that there is a pattern of serial monogamy in the culture. More gay men and lesbians are also pair-bonding openly. So, there are other alternatives to heterosexual nuclear family monogamy, and not all pair-bonding takes place between opposite-sexed couples.

We will not address the point concerning the inevitable arrival of children soon after heterosexual pair-bonding. However, the whole question of population/space/resources should be looked at in more detail, we think. Even if there is now unlimited room for the expansion of the species, it is unlikely that we will be able to do that with unlimited speed, so we will probably need to continue to monitor our birth/death ratios well into the colonization age ahead, and many couples will likely still want to defer having children or not have them at all, as is the case today in advanced technological societies like our own.

We would like to attend the Careers in Space conference in San Francisco in 1980, as you suggest. But we are not interested in being "caught" by some sweet young space cadet, and we know a lot of women who are not interested in chasing. We'd like to help organize a section of the conference which would address some of the issues raised in your column and in this letter, with a view to facilitating the full participation of cultural/sexual/national representatives of human diversity. Let's see if we can behave, in our planning, as if courage, honor, self-commitment, hard work, self-reliance, generosity and (s)heroism were attributes of our species, not just of the monogamist heterosexual whites among us.

It is our hope that our journey into space will be also a quest for societies in which all peoples share in the wealth and resources; where diversity in opinion and lifestyle are not only accepted, but honored and encouraged.

We tried it once, 200 years ago, in America. Let's take what we've learned and do it better.

Dean Gengle  
Steven S. Smith  
San Francisco, CA

Carolyn Henson replies: I'm sorry you interpreted my praise of marriage and family as an attack on gays, non-whites, etc. Believe it or not, it's possible for an individual—even me—to appreciate multiple lifestyles.

Speaking of "multiple" . . . I just gave birth to another baby, Virginia Heinlein Henson. I won't tell you how many kids I have or my rate of production of them because it might inflict a heart at-

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tack on you, and I wouldn't want to carry that on my conscience. But can't we have a future in which some people have no kids and others many, without accusing either the no kids or many kids people of wickedness? (Kids are the future, and I'm darned glad our society lets me help create as much future as I wish.)

## ALTERNATE VIEWS

... FUTURE LIFE has distinguished its relatively short career with a very high standard of journalism, notable for both its technical validity and depth of thought. It was therefore with extreme disappointment that I read "Lovers, Colonists and Explorers" by T.A. Heppenheimer and "New Sources of Energy" by Harry Harrison in FUTURE LIFE #15. The former is ponderously prosaic, the latter frighteningly simplistic.

Mr. Heppenheimer's scenarios rest on technically precarious ground. For example, the single-stage-to-orbit spacecraft shown is nothing more than the space shuttle, not the air-breathing scramjet described. But where he really bogs down is in his tunnel-vision perception of the potential diversities of future life. All he has done is to superimpose minutia of the present on the fabric of the future. His incessant descriptions of golf courses and lovemaking are a weak smoke screen for his lack of conceptual substance.

Incidentally, all of the advantages of zero-g sex would not be available to the average space colonist in everyday life. We must assume that an "artificial" gravity is provided by centrifugal force or else Mr. Heppenheimer's foursomes would be teeing off into a homogeneous smog of sand, sod and fescue. This means that zero-g would exist only at the colony's center of rotation. Given the restricted availability of zero-g and the already demonstrated need for training



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F18

# input

and acclimation to its unique "properties," weightless sex will most likely be available in a well-defined district of specialty shops, staffed by experienced practitioners of the art. Mr. Heppenheimer (and his readers) would have had a lot more fun considering possibilities such as these.

Mr. Harrison, on the other hand, ignores and misapplies facts to present a very convoluted picture of our energy options. He extols the conservationists as having had the answer to our energy problems all along. And while it is true that conservation must be an integral part of our energy strategy, using energy at a reduced rate only prolongs the inevitable since our terrestrial resources are finite. Our real problem is not energy conservation, but rather energy production. Unfortunately, energy production of any form (including solar) perturbs ecosystems to degree proportional to the magnitude of the energy needed and the accuracy of our perception of the perturbation.

Obviously there can be no valid simple description of where our energy path should go. But no matter what the path, the keys to understanding our true options and translating them into reality are knowledge and perspective. We must, as a nation, understand both sides of the story. The "inflated" military budget that Mr. Harrison deprecates has in fact made possible *all* of the technological resources and tools that he cites as our energy hopes for the future. "Peaceful" research and development just doesn't draw the required funding, as shown by the shameful neglect of NASA's budgetary needs in the past decade.

Henry Caruso  
Glen Burnie, MD

### POWER PLUG

...I can't argue with Harry Harrison's timely remarks on "New Sources of Energy" (FUTURE LIFE #15), since they mirror almost exactly my own conclusions in my new book *Energy and the Future*.

But I can't let him get away with his glib assertion "...the hydrogen can be liquified and put into the auto tanks." Certainly hydrogen has attractions as an almost non-polluting fuel, but as I point out, it requires a temperature of -253 degrees C to liquefy it and producing this uses energy, while storing it adds weight to a vehicle. Hydrogen also explodes with an ignition energy 15 times less than natural gas (and stores about one-third as much energy), so is not likely to be stored on garage forecourts like gasoline! Methods of storing hydrogen in solids which "soak it up" are more promising.

David A. Hardy  
Birmingham, England

### DAMNATION

...I read with interest FUTURE LIFE #16 concerning the technological advances in store for the 1980s. But I find I must question the tone in which your Tellico Dam project article was written (Earth Control). As I read through, I felt I wanted to agree, but I couldn't make an honest decision due to the prejudiced view taken by the writer. Unless we are to believe that the U.S. government decided to stick a dam in the middle of nowhere just to irritate a few fish, one must assume there is a side of this question which has not been properly researched. *Someone* must have had a good reason for this dam, even if it was not as good as the strong reasons against it.

I have always appreciated the editorial frankness taken by the staff of FUTURE LIFE, but in

this case it seems the editorial page has reached out and touched what should have been an unbiased, two-sided account of a serious situation. I happen to agree with the views Mr. Woods puts forth, but I do not feel they were presented in a manner which enabled the readers to make an honest decision.

Paul R. LeBlanc  
London, Ont., Canada

### THEREFORELY

...I am aware that everyone has a bad day now and then and that lapses of intellect will occur, thus I will assume that the grammatical *faux pas*, "...thusly," in Ed Naha's *Star Trek* piece on page 23 of FUTURE LIFE #16 was a slip of the typewriter or the malevolence of printing gremlins.

G. Davis  
Portland, OR

### ANIMATED TREK FAN

...Ed Naha's excellent article on the evolution of the *Star Trek* phenomenon failed to mention one unique and critical step in the show's development, that being the resurrection of the show by NBC as a Saturday morning animated series during 1973-74.

Although economically produced with scripts lacking the originality and polish of the original series, the animated *Star Trek* still stands as one of the most intelligent and sophisticated kiddie-shows ever aired, and represents yet another of this seemingly invincible property's many and varied permutations.

Now that *Star Trek—The Motion Picture* is smashing box office records from coast to coast (despite mixed reviews), we who have been with the series since its premiere can rest assured that Captain Kirk and crew will continue to boldly go where no man has gone before. After 15 years, it seems the *Star Trek* adventure is just beginning.

Allen B. Ury  
Wilmette, IL

### ANTI-GAY

...I could not let Andy Guthrie's letter, "Gay Science Fiction" (FUTURE LIFE #17), go unchallenged. I submit that science fiction featuring (or promoting) homosexuality is not being written and accepted by SF mainstream fans and writers for the same reason that child molestation and rape isn't being glorified by SF. Although there's a noisy minority who are trying to push "pervert lib" down society's throat, most people are too intelligent to believe that we should accept every social disease that comes down the pike as an "acceptable alternate lifestyle."

The analogy between the struggle for blacks' civil rights and "gay" rights is absurd. Skin color is an evolutionary adaptation to different environments; homosexuality is a perversion of the sex act. If I were black, I'd be sorely offended. As a matter of fact, I am white and sorely offended!

David A. Krouse  
Wallingford, PA

### ATTENTION SUBSCRIBERS

Effective with the mailing of this issue, FUTURE LIFE has a new mailing address for renewals, change of address notices and all subscription inquiries. Address your subscription related inquiries to: FUTURE LIFE, Subscriber Services, P.O. Box 142, Mt. Morris, IL 61054. We hope that this new central location will enable us to serve you more efficiently.

# databank

HIGH FRONTIER

## SPACE COLONY MOVIE IN PRE-PRODUCTION

Just when the likes of *Star Trek* and *The Black Hole* were beginning to make some of us wonder about the shape of science fiction films to come... word arrives about a major motion picture rumored to have such elements as an intelligent script, three-dimensional characters and a science fictional future that could come true in our lifetimes. The film centers around life in a space habitat, specifically the Island One concept pioneered by Gerard K. O'Neill.

Super space artist Robert T. McCall has been enlisted to do production illustrations for the film project. Although the film's producers have sworn McCall to an oath of secrecy concerning such details as the script, the target release date and even the working title, the artist is enthusiastic about the scope of the motion picture.

"I'm delighted to be working with Gerry O'Neill on a movie that deals with space and the future as a real, living possibility," McCall says.

No newcomer to SF film endeavors, McCall did production illustrations for both *The Black Hole* and *Star Trek—The Motion Picture*, as well as spacecraft designs for *Buck Rogers in the 25th Century*; his poster art for *2001 A Space Odyssey* are classics. In addition to his SF credentials, McCall is one of the outstanding chroniclers of the real-life space program—past, present, and future. His sweeping murals at the National Air and Space Museum and at Johnson Space Center are monuments to the



Bob McCall shown with his 16-by-72 foot mural entitled "Opening the Space Frontier" in Houston.

human exploration of space.

So McCall is right at home envisioning a cinematic story set in the relatively near-term, realizable future... a future he happens to support

wholeheartedly. "It's an opportunity to communicate to people in a way that will stimulate and inspire them," he says. "The human settlement of space offers us a real chance to solve

the energy crisis and many other problems. And it puts us on the threshold of the ultimate frontier. This movie project is more than just another fantasy." —Robin Snelson

## SPACE SAVIORS

### VIKING RESCUE UNDERWAY

In the Databank section of FUTURE LIFE #16, author Leonard David told the sad tale of the Viking landers, whose voices, transmitting important data from Mars, are destined to become silent unless enough money—one million dollars, to be exact—is raised to keep them operating. An organization called the Viking Fund, operated by the San Francisco section

of the American Astronautical Society, is collecting contributions towards that worthy goal. We recently received the following letter concerning the wide response Fund organizers received from our readers:

"On behalf of the Viking Fund I would like to thank you for publishing Leonard David's short news item about the Fund. The response has been tremendous and you should be proud of your readers. Their letters indicate a tremendous amount of grassroots support for space activities

such as Viking, and a general frustration with the current dismal program.

"We are very confident about reaching the one million dollar goal if the response we are seeing here is typical of the response we can expect on an overall basis."

The responses ranged from a Canadian student to the commander of a submarine group based in Seattle. Along with all other contributors, they will receive an open invitation to the presentation of the Fund to NASA in Washington D.C. this com-

ing July. According to a bulletin put out by the Viking Fund, this project "affords an opportunity for grassroots support for the space program to be heard, and heard in an extremely vivid fashion." In fact, at least one of the contributors, responding to the article, asked, "Would it be possible to have a major contribution campaign for the NASA space program?"

Anyone wishing to help should mail donations (minimum amount \$1.00) to The Viking Fund, PO Box 7205, Menlo Park, CA 94025.

SCI-FI

## SIMON SPOOFS ALIEN ARRIVAL



Alan Arkin: Is he or isn't he an alien from a far-off world?

Orion Pictures is unveiling a close encounter of the absurd kind this month in the personage of *Simon*. *Simon* is an alien invasion film with a twist; there are no aliens in the movie and no invasion ever takes place. Instead, the film recounts the misadventures of eccentric college professor Simon Mendelssohn (Alan Arkin), an unassuming type who locks horns and frontal lobes with the members of the Institute for Advanced Concepts; an American think-tank of the slightly drained variety.

The Institute is populated by a bevy of screw-loose scientists who have, over the past ten years, caused most of the more idiotic historical events that have popped up around the world. Their newest project involves an alien invasion scam, a mock close encounter designed to stimulate society. In order to carry out their plans, however, they need a subject who is totally innocuous. A man with no family or social ties. A nebbish whom no one will miss should he disappear. In short, they need Simon Mendelssohn.

Mendelssohn, a fellow who dab-

bles with sensory deprivation chambers, is enticed into the Institute and kept on the premises through the efforts of attractive albeit addle-brained Cynthia (Madeline Kahn). Showing up with a handful of clothes, a few wild ideas and a saxophone, Simon emerges from the think-tank as the most powerful man in the world. The scientists convince him that he is indeed the first alien visitor to land on Earth; the possessor of unlimited power. Since Simon was always a bit off-the-wall anyhow, most of his old friends can readily accept the story of Simon's "true" origins. Alien Mendelssohn first becomes a media personality, then a cult hero and, finally, an outlaw in what Orion Pictures is touting as one of the most hilarious comedies to come down to Earth in years.

Simon was conceived and directed by Woody Allen alumnus Marshall Brickman and produced by Martin Bregman. Also featured in the film are Judy Grabart, Austin Pendleton, Carleton Carpenter, Fred Gwynne, Adolph Green and David Susskind.

—Ed Naha



Nutty professor Arkin takes think tank members into deep space.

## ROCK STARS

### TOMORROW'S BUMMERS ARE BIMMERS

The nightmarish world of 1984 is currently being upstaged at several West Berlin studios as the BIMunized year of 1994 takes shape for the forthcoming film *The Apple*. The \$12 million science fiction rock opera is a dystopian glance at a future where the world's youth population is ruled by exponents of BIM music: a techno-disco-rock sound that is also a look, a way of dressing, moving and living. Ruling the realm of BIM are evil Boogalow and Shake (Vladek Sheybal and Ray Shell), two music moguls who promote both Saturday Night Fever and Sunday Morning drug hangovers. Their main marketing tools are BIM stars Pandi and Dandi (Grace Kennedy and Allan Love), sterile rock automatons that make Barry Manilow look like Mr. Personality.

Their BIMunized empire is nearly wrecked when singing duo Bibi and Alphie (Catherine Mary Stewart and George Gilmour) attract the public's ear by crooning sincere, old-fash-

ioned love songs. Boogalow acts, attempting to lure the dynamic duo into the BIM fold by hook or crook or drug induced euphoria. Aiding the hapless kids is mysterious Mr. Tops (Joss Ackland), a fellow who sometimes travels out of this world in his attempts to bring true feeling back to the Earth.

If the plot of *The Apple* sounds a bit disjointed, rest assured it's intended to. Choreographing the frantic film-full of new faces is a group of seasoned pros. *The Apple* is being produced and directed by Menahem Golan, who garnered four Oscar nominations for his work on *Sallah, I Love You Rosa*, *The House On Shloush Street* and *Operation Thunderbolt* and whose last film, *The Magician*, was based on the novel *The Magician of Lublin* by Nobel Prize winner Isaac Bashevis Singer. The film is being designed by Oscar-winning art director Jurgen (*Cabaret*) Kiebach with futuristic costumes provided by one of Europe's leading fashion designers, Ingrid Zore.

Cannon Films plans to release the *The Apple* sometime later in the year—providing the cast and crew doesn't get BIMmed out in the interim.

—Ed Naha



Mr. Tops (Joss Ackland) lives up to his name in film's finale.

## FUTURE FLICK

### OLD FACES = NEW FILM

Sean Connery, the star of John Boorman's infamous SF adventure *Zardoz*, will once again journey into the future in the forthcoming thriller *Outland*; a movie which Peter Hyams is writing and directing for the newly formed Ladd Company. Hyams, whose last original SF effort was the scientific-Watergate

exercise *Capricorn One*, will begin filming in June at London's Pinewood Studios with a stateside release date slated for the summer of 1981 via Warner Brothers Films. *Outland* is the first overseas project for the recently inaugurated Ladd Company. The production outfit is helmed by Alan Ladd Jr. who, as president of 20th Century Fox, gave science fiction filmdom a much needed shot in the arm with such successful offerings as *Star Wars* and *Alien*.

—Joseph Kay

## DISASTER FILM

### FALLEN FANTASY

In FUTURE LIFE #17 we reported on the projected filming of Barry Ira Geller's \$50 million fantasy epic *Lord of Light* (adapted from SF writer Roger Zelazny's novel of the same name); and on the planned subsequent transformation of the film's set near Denver, Colorado into a 1,000 acre theme park. We also mentioned a certain amount of public skepticism concerning the success of Geller's elaborate project. It seems that the skeptics were more than justified.

A reporter for the *Rocky Mountain News*, Bob Weiss, has since uncovered several interesting facts which may serve to deter future investors in the project:

Officials of the Royal Bank of Canada, from which Geller supposedly got an irrevocable letter of credit for \$400 million, denied that such a letter was ever issued.

A PBS spokesperson denied that Geller's partner, Gerry Schafer, ever produced a documentary for them. Schafer had used the documentary to establish his credentials as supervising producer.

The district DA reported that Schafer had never registered a \$50,000 investment (considered a security under state law) with the state. This money, by the way, was obtained from an immigrant with only a slight command of the English language, who was assured a 50 percent return on his investment.

These, along with various other factors, culminated on Thursday, December 27th, when Schafer, Geller and Larry Chance, vice president of Schafer's company, were charged with a total of 11 felonies at the district court. These charges included theft, conspiracy, and three counts of security fraud.

Therefore, at this point, *Lord of Light* seems to be a rather unlikely proposition. Better luck next time.

—Barbara Krasnoff

## CINEMATIC STUFF

### SCIENCE FACT FILMS ON THE WAY

United Artists has announced plans to release a motion picture adaptation of Tom Wolfe's book *The Right Stuff*. The recently released best-seller recounts the behind-the-scenes adventures of the seven Mercury astronauts during the early years of NASA's manned space program. Also in the works, independently, is a film version of Kenneth Brower's non-fiction work, *The Starship and the Canoe*. Producer Robert B. Radnitz wants filming to begin no later than the fourth quarter of 1980 and

## SPACE OPERA

### CORMAN SENDS JOHN-BOY INTO SPACE FOR SUMMER VACATION

This July, Roger Corman's New World Pictures will launch actor Richard Thomas (aka "John-Boy" of TV's *The Waltons*) into space in the film *Battle Beyond The Stars*. Thomas will star as rocket jockey Shad, a young, righteous rebel who must recruit six alien swashbucklers to help him defend his farm-world planet from the marauding minions of the sinister spacefarer Sador. The film is loosely based on either *The Magnificent Seven* or *The Seven Samurai*, depending on one's cinematic point of view.

The most expensive New World picture ever, with a budget of close to eight million dollars, *Battle Beyond the Stars* is being directed by Jimmy T. Muramaki, best known stateside as the director of aerial scenes in Corman's *The Red Baron*. Chuck Comisky of TV's *Space Academy* is supervisor in charge of special photographic miniature effects and George Dodge, cinematographer for many of the *National Geographic* television specials, has been recruited as co-director of photography, miniatures and special effects. Sharing directing chores with Dodge is Dennis Skotak



PHOTOS © 1980 NEW WORLD PICTURES



Above: model makers work on one of the space ships being used in *Battle Beyond the Stars*. At left is a finished vessel.

who handled effects for *The Demon Lover*. Ken Jones, who headed up the imaging team for the Mars lander at Jet Propulsion Laboratories, has been tapped for the slot of technical director and special effects consultant.

Jones and the SFX crew will be using the latest in effects technology to carry out the film's various spacey effects. Among the principal systems being used are the Elicon System: a 40-foot precision machined track and computerized motion picture repeat-

ing system; and the Electronic Composite Printer: a new electronic system capable of flawlessly compositing foreground and background plates for wild and woolly effects sequences.

*Battle Beyond the Stars*, originally slated for production in 1979, was delayed a year in order to raise additional money for the film's effects budget and to give the screenplay a final polish. It is New World's most ambitious SF venture to date.

—Al Flynn

## KID-ED

### PLAY WHILE LEARNING AT SESAME PLACE

Three-year-olds in pursuit of science and knowledge will be trotting through the gates of "Sesame Place" when it opens in Lower Bucks County, PA this June.

Sesame Place is the \$6-million prototype for a series of educational play parks developed by Busch Gardens, the family entertainment division of Anheuser-Busch, Inc., and the Children's Television Workshop, best known as the creator of the educational TV programs *Sesame Street* and *The Electric Company*. Designed for families with children from age three to 12, the parks aim to stimulate the intellectual curiosity of children through play.

Outdoor activities at the 15-acre Sesame Place, tailored to age, will include a Foam Swamp, a 3-D Shadow

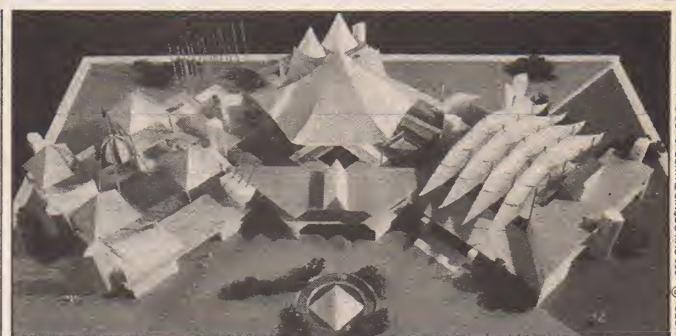


PHOTO © 1980 CHILDREN'S WORKSHOP/BUSCH GARDENS

Designer Eric McMillan's model of the innovative new play park.

Dance, and simple machines such as gears, pulleys, windmills and water wheels. The indoor Science and Game Pavilion will include more than 60 electronic games and hands-on science exhibits, ranging from talking typewriters featuring Sesame Street characters to remote mechanical hands like those used in industrial plants.

"We've selected material from

museums and science and computer centers across the United States," says CTW creative consultant Christopher Cerf, "and adapted the best of what's available in current technology to the needs of young children."

"Even three-year-olds," he adds, "can have fun with computer games and begin to learn some basic scientific concepts."

—Pat Glossop

plans to find a major father-and-son acting team for the starring roles. *The Starship and the Canoe* is the story of noted astrophysicist Freeman Dyson and his conservationist son, George. Dyson senior is a professor at the Institute for Advanced Study in

Princeton and has helped devise a theoretical spaceship powered by a chain reaction of nuclear explosions. The younger Dyson has spent most of his adult life living in a tree house located in a Douglas fir forest in British Columbia. Radnitz is excited

about the odd-couple project because, in his words, "It is the first story of father-son conflict to reflect the reversed realities of youth-middle age perceptions occasioned by the social revolutions of the '60s and '70s."

—William Pratt

## LASERS ON PARADE

### TRIPPING THE LIGHT FANTASTIC



A multi-media laser light and special visual effects event

## TALKING TABLOIDS

### MAGAZINES THAT TALK BACK

**B**ummer. Martians landed on the front lawn of the White House last week, and you missed hearing the Earth-shattering speech given by the alien ambassador. But fear not, posterity collectors. Here comes your weekly issue of *Time* magazine, complete with a sound recording of the address, laminated right onto the page.

The Martian part is fiction (of course), but the talking magazine is not too far down the line, according to *Advertising Age* magazine. It was at a recent *Ad Age* media workshop that Malcolm Ochs, research director for *Time*, disclosed the breakthrough. "There is technology available right now that can imprint grooves right on the page of the magazine," Ochs reports.

*Time*, Inc. is reportedly close to finalizing a deal with Microsonics, Inc. of Torrance, Calif. Microsonics will supply the software for the innovation. This consists of a two-inch, 90-second soundtrack pressed on extremely thin sheets of transparent polyvinyl chloride (the stuff conventional LPs are made of). The "talking" device is a small microphonograph—approximately the size of an electric razor—to be supplied by Kyushu Matsushita Electric Co., the Japanese parent of Panasonic.

Besides the novelty of having sounds accompanying the printed words, *Time*'s Ochs feels that their talkie might also be a boon for advertisers. "You could do a lot more with your ad than just the regular color or black-and-white layout," Ochs says.

Problems? Of course...but they seem temporary, according to John Wickel, executive vice president of Microsonics. The first problem involves affixing the sound sheets on today's high-speed presses. "We can't do it right now," admits Wickel, "but we're working on a process."

Obstacle No. 2 is the cost of the microphonograph (a battery-powered unit with a stylus that tracks in a circle from the center of the recording at speeds up to 133 rpm), which presently would cost between \$80 and \$90. Wickel believes, though, that mass production would trim the price down to about \$15.

Reg Brack, associate publisher at *Time*, told *FUTURE LIFE* that the talking mag is a bit further away than *Ad Age* reports. According to Brack, *Time* is presently gearing up for some market testing and technological experimentation, and that an actual talkie is a year or more away from reality. Furthermore, it will be at least five years before any mass production would be available. But then, it might be another five years before the Martians land, too.

—Bob Woods

## ALIENATION

### UFOs ARE FAKE?

**R**ecently there was an unprecedented chance for anyone who so desired to pick up an easy one million British pounds (roughly equivalent to two million American dollars). How? Very simple—provide Cutty Sark Ltd. with an authenticated piece of a UFO.

Not much to anyone's surprise, there were no legitimate claimants to the prize. However, science writer James Oberg won first prize of a thousand pounds in a separate category, for an essay entitled "The Failure of the 'Science' of Ufology."

Oberg, who is presently a McDonnell-Douglas contractor to NASA specializing in computer control of orbital maneuvering and attitude control rockets, has written extensively about UFOs in various publications. In his winning paper, he stresses the role that the researchers of possible UFOs, or

"ufologists," have played in the non-acceptance of ufology as a legitimate field by the scientific community. "Ufology," he writes, "allegedly refuses to play by the rules of scientific thought, demanding instead special exemptions from the time-tested procedures of data verification, theory testing, and the burden of proof....

"The pity is that if such eventualities should come to pass, and the ufologists are proved 'right', they will in all probability have impeded rather than accelerated the acceptance of that phenomenon by traditional science. This is because the new theories will most likely be championed by those ufologists already badly discredited by too many cries of 'wolf!', by too many endorsements of what subsequently turned out to have been hoaxes, and by too many anti-scientific assertions and claims. They would be 'right' only by accident, not by their own virtue."

—Barbara Krasnow



Above: UFO debunker James Oberg and a pro-UFO spokesperson.

## HOME ON LAGRANGE

### L-5 LAYS PLANS FOR AMBITIOUS '80s

**C**arolyn Henson, *FUTURE LIFE*'s Alternate Space columnist, recently left her post as president of the L-5 Society, the organization dedicated to the large-scale industrialization and settlement of space. For nearly five years, Carolyn and husband Keith, co-founders of the L-5 Society, have spearheaded a growing movement to accelerate the pace of off-planet endeavors. While it's unlikely that the Hensons will abandon their activist roles in this movement, the reins of the Society have been passed over to another devoted space advocate, Gerry Driggers.

In addition to his 14 years of experience in the aerospace field, Driggers was closely involved with all the space settlement studies conducted in the 1970s. The new president has ambitious plans to expand the scope of the L-5 Society, beginning with a membership campaign intended to double the Society's numbers every year. "I believe it is important to the

future of the United States and the world that we grow, in order that the message of a hopeful future can be spread and key influences can be exerted," states Driggers. "A grassroots organization such as ours can command considerable attention during the 1984 election year if we start work now." (Prospective members may write to the L-5 Society at 1620 N. Park Ave., Tucson, AZ 85719 for membership information.)

Driggers also plans to put L-5 Society members to work nationwide on a broad spectrum of projects aimed at furthering the L-5 goals, and has announced plans to expand the coverage of the *L-5 News*, a monthly publication which reports on political and technological developments relating to the human settlement of space. "I consider this one of the greatest opportunities ever presented to anyone," Driggers says of his new post, "to be asked to lead a truly dedicated organization into what will very possibly be the most challenging decade in the history of the United States. If we pool our resources, we will not simply reach for the stars. We will touch them."

—Robin Snelson

## ON THE BEACH

### WHALE TALE

Scientists had their first chance to study one of Earth's most mysterious creatures nose-to-blowhole when a newborn baby sperm whale stranded near Rockaway, Ore. last September. Nicknamed 'Florence' for the site where 41 of her kind beached in July, the infant whale was discovered by two honeymooners out for a stroll, and transported to the Seattle Aquarium by volunteers from Oregon State University and Greenpeace.

Even in the safety of a shallow pool, Florence required intensive care to help her breathe and swim. Teams of attendants continuously supported her head in a sling, while veterinarians took blood and stool samples in an effort to diagnose the illness that beached her. Electrocardiograms were also obtained—the first from a sperm whale.

Although she sometimes broke free of the sling and rammed the walls of her tank, Florence's behavior towards her keepers was marked by unexpected gentleness. She seemed to enjoy the human touch, and liked having her gums stroked. When new attendants entered her pool, Florence showed awareness of their presence by altering her swimming pattern—even while asleep.

Faced with the problem of finding a substitute for whale milk, Dr. Tag Gornall, of Seattle's Marine Animal Resource Center, finally settled on a mixture of goat's milk and creamed

krill, administered by a pump—not haute cuisine, but hopefully nourishing.

Of special scientific interest are hydrophone recordings of the sounds Florence made. During her captivity, the baby whale emitted sighs and groans of pain as well as clicks characteristic of whales' echolocation. Their meaning is, at present, unknown, but cetologists hope to someday break the 'code' of cetacean communication.

Despite intensive efforts by marine mammal experts and volunteers, Florence died on September 21, three days after her arrival. Though the odds in her favor were slim, the round-the-clock vigil to save her was hardly in vain. Minutes after her death, Gornall and other M.A.R.C. members began a necropsy, which revealed the cause of death as twisted bowels. Perhaps the most important sample taken was the brain, believed to be the first recovered intact. According to Gornall, Florence's brain, already larger than a human's could provide data for future research on sperm whale brains, the largest biocomputers on Earth.

Before Florence beached, most human knowledge of sperm whales was gathered from studies made aboard whaling ships. The information gained from her could save the lives of other beached whales. Although her life was short, Florence's contribution to our understanding and appreciation of whales will be long remembered.

—Craig Thompson  
& Malcolm Brenner

## PUSHBUTTON PUBLISHING

### TOMORROW'S MAGAZINE: COMPUTERIZED FOR YOU

The publishing industry may soon have a new weapon to use in its fight against the rapidly rising electronic media. According to *Advertising Age* magazine, a Denver-based company called U/Stat Inc. is planning to provide magazine publishers with a new service: personalized magazines.

What is a personalized magazine? Well, say you are a rabid anti-smoker with a consuming interest in soybeans. Using this system, you would get your copy of *Ceiling Painters Monthly* with an extra page of soybean recipes inserted and all cigarette ads discreetly absent.

According to Tom Pardis, president of U/Stat Inc., a new system of "computerized collation" would both provide readers with specialized editorial material and ensure a selective grouping of advertising for a specific audience. Subscribers would be polled in advance as to their likes

and dislikes, the resulting information would be fed into a computer, and that, together with a sophisticated collation system, would allow the pages of each magazine to be tailored to the individual reader.

One problem with this system is that many otherwise willing consumers might see such a poll as an invasion of privacy and refuse to fill it out. In order to test the probability of this, U/Stat queried 15,000 potential subscribers about a fictional personalized magazine. They found that 76 percent of those who responded to the mailing were willing to fill out a detailed questionnaire concerning their interests. And one of the more sensitive issues—income—could easily be avoided because, Pardis asserts, "Income becomes irrelevant when we already have learned what we really want to know—how much that reader invests in a certain activity."

Pardis says that four major magazine companies, two consumer and two business trade publications, are seriously thinking about incorporating U/Stat's method to produce the first personalized magazines.

—Barbara Krasnow

## INTELLIVISION

### NOVA'S 79-80 SEASON ENDS



PHOTO © 1980 PBS

Veteran Eskimo whaler Billie Webber with wife and prize catch.

**N**ova, PBS's award-winning science series, will end this season's first run presentations during the month of March before entering into several months of reruns. The final episodes of the 1979-1980 season include "Umealit: The Whale Hunters" (March 4), "The Safety Factor" (March 11), "A Mediterranean Prospect" (March 18) and "Mr. Ludwig's Tropical Dreamland" (March 25). "Umealit" takes *Nova* viewers to Point Hope, Alaska, where Eskimo whalers hunt down the rapidly diminishing population of bowhead whales using snowmobiles and explosive harpoons. With the ecologists' cry of "Save the whales!" echoing round the world, the whalers pursue their prey as they have for generations, using stealth and cold determination. "The Safety Factor" recounts the flight of a Laker Airways DC-10 as it crosses the Atlantic from London to Los Angeles. For each of

the passengers aboard, the chances of not making it stateside are three in one million. Yet recent crashes involving DC-10s have made even the most stalwart of travelers jittery. *Nova* explores the safety standards currently enforced by the Federal Aviation Administration. "A Mediterranean Prospect" portrays the somewhat endangered future of one of the world's most popular tourist spots...the Mediterranean coast. Pollution in all of its varied forms currently threatens this lush beach property. Dr. Stjepan Keckes, the head of a small United Nations team, is dedicated to eradicating that threat within his lifetime. "Mr. Ludwig's Tropical Dreamland" introduces viewers to the boldest capital enterprise of the century. On three and a half million acres of Amazon rain forest, a reclusive billionaire attempts to cultivate wild land into a commercially profitable city-state.

—William Pratt

## DNA & U

### GENETIC ENGINEERING ON MAMMALS NEAR?

**A**ssements of the near-term prospects for genetic engineering—the creation of "new" organisms using recombinant DNA techniques—have generally focused on bacteria. Higher organisms, both plants and animals, have been considered much more distant possibilities, largely because of difficulty in getting the new gene safely into the recipient. About the best way to date has been with viruses that have the undesirable property of either killing the recipient cell or rendering it cancerous.

Suddenly all this has changed. Dr. W. French Anderson of the National Institutes of Health and his colleagues at NIH and Rockefeller University have found to their surprise that if they inject mouse cells with bacterial plasmids (small accessory chromosomes, often used as vectors

in bacterial genetic engineering) these plasmids reproduce right along with the cells; thus the genetic information they introduced remains associated with the cell and its descendants indefinitely. Since the plasmids have no side effects, this lifts a major block to genetic engineering of higher organisms.

Anderson and his colleagues have already used their technique to "cure" a line of mouse cells lacking the enzyme thymidine kinase. What are the prospects for similarly curing human diseases, such as Tay-Sachs and sickle cell anemia, due to identified genetic deficiencies? Unfortunately the plasmid remains associated only with descendants of the cell into which it was originally injected. Unless we can inject the plasmid into the early embryo—which seems unlikely—this sharply limits the technique's effectiveness. Yet the fact remains that both cures for human genetic diseases and improved strains of domestic animals are now one step closer.

—W.A. Thomasson

**F**or over a hundred years, railroad networks formed the arterial lifeline of most industrial nations. Then in the mid-1950s, complex freeways and super highways made auto and truck travel much easier and swifter. Jets began to connect far parts of the nation and the world in a matter of hours. And it looked as if traditional rail traffic would eventually be eclipsed by these faster modes of transport—especially for long distance travel.

But then came a greater awareness of man-made ecological imbalances, and a growing shortage of fossil fuels. People once again started looking at mass transport alternatives. Technological advances, especially in computers, allowed for a resurgence in fast, dependable rail transport. First in crowded

Bullet train (officially known as the New Tokaido) went into operation between Tokyo and Osaka. Express trains on this route are able to complete the 500-kilometer run between the two cities in slightly over three hours, averaging 208 kph, and reaching peak speeds of 240 kph. The trains are now fully computerized; operators are needed only to start the trains, stop at stations and open and close doors. Even most of these functions could be automated as well, but haven't been for psychological reasons.

Because such high-speed trains accentuate track deficiencies and aggravate problems, such as rails that don't fit snugly, the Japanese National Railway put down special track in which the rails are welded together and imbedded in concrete.

# Trains of Tomorrow

By ALAN BRENDER

Japan, then in densely populated France and Britain, new types of trains—faster, quieter, more fully automated—were developed and put into service.

These trains of the '70s and '80s travel at speeds sometimes up to 260 kph (163 mph); and Japan, France, Britain and Germany are developing even faster trains that will no longer rely on the flanged wheel and the double metal rails. By the end of this century, trains will be floating above guideways at speeds exceeding 500 kph—virtually noiseless and vibrationless. Farther into the future, there is a serious proposal—currently technologically feasible—to develop an underground rail system that could whisk a passenger from New York to Los Angeles in 21 minutes at a fare of less than \$50.

Proponents of rail transport argue that this form of transportation disturbs the national environment less than highway construction. Far fewer pollutants, they say, are emitted from train engines per unit of transport compared to road transport or air carriers. And trains utilize fuel more efficiently than corresponding forms of transportation.

Because of its extremely dense population and total reliance on outside sources for hydrocarbon energy, Japan early recognized the need to improve its rail transport to conserve energy and reduce pollution. The Japanese National Railway launched the new era of the railroad in 1964 when its famed

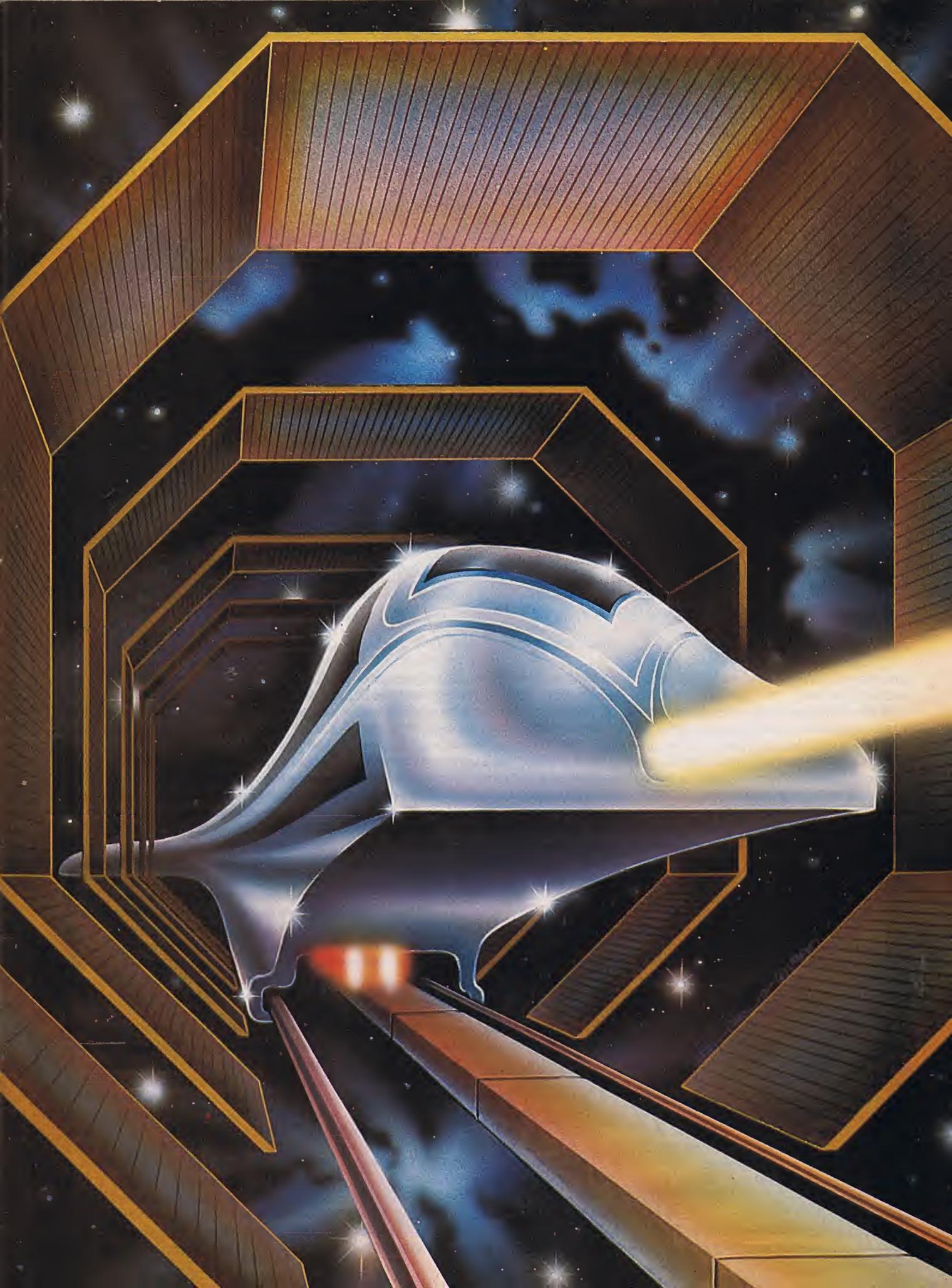
Newer high-speed lines, using techniques developed in the construction of the New Tokaido line, are being built throughout Japan today. In the 1980s, most parts of Japan will be connected by high-speed trains—even the northern island of Hokaido. To hook Hokaido into the network, the

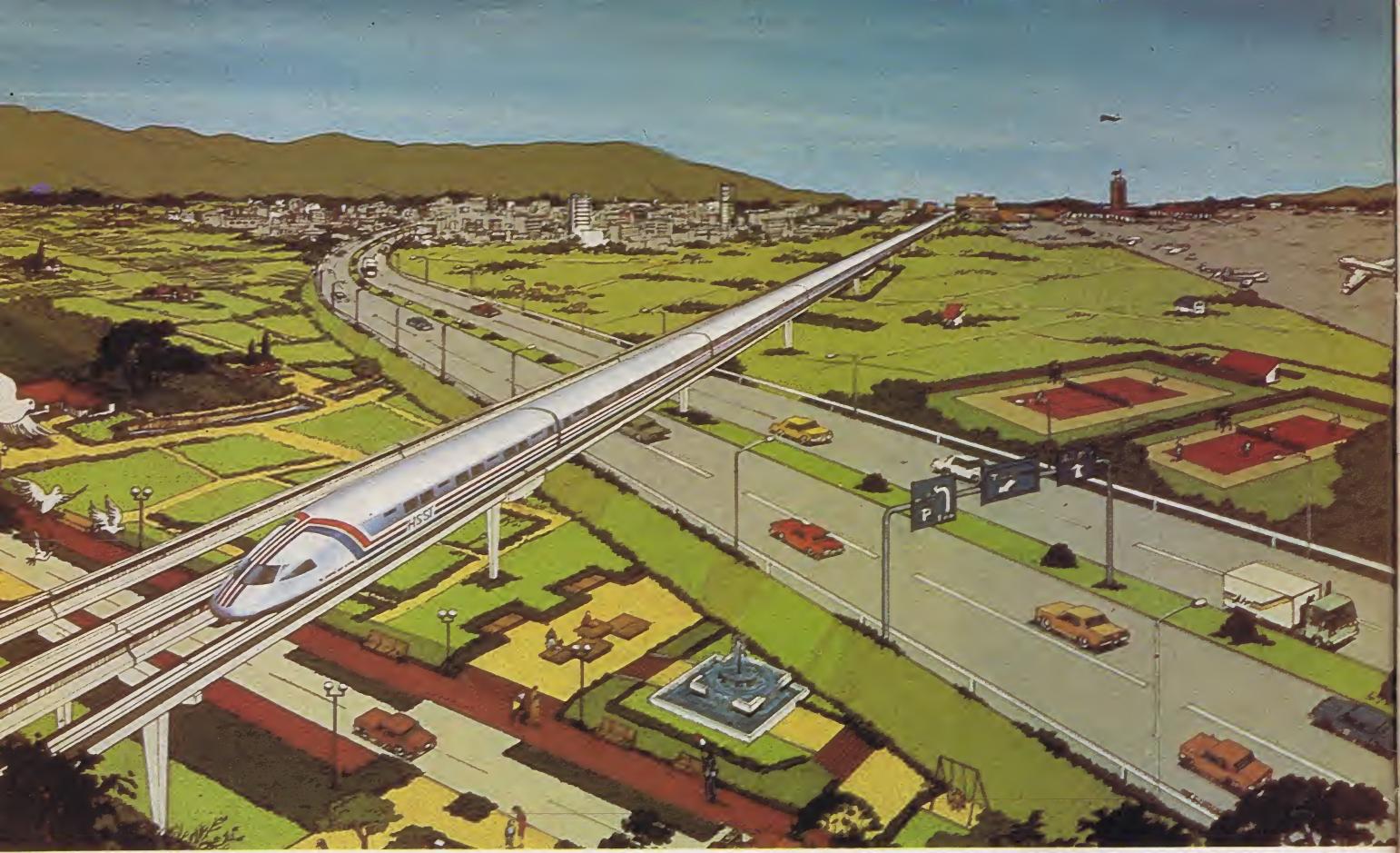
world's largest underground rail tunnel (50 km) has been constructed 100 meters below the sea bed and 210 meters below the surface of the Pacific Ocean. More than \$200 million has been spent on this 14-year project.

In Britain, British Rail has launched an innovative program that is reducing travel time between cities without resorting to costly and time-consuming laying of new welded, concrete-imbedded track.

The first stage of the program, in the early '70s, involved the electrification of the main north-south line between London and Glasgow and putting into service diesel engines capable of speeds of 160 kph. An hour was shaved from the original six-hour travel time and ridership rose 50 percent.

Once this was accomplished, British Rail introduced its High Speed Train (HST), which is capable of operating at 200 kph over existing track. And beginning in the 1980s, British Rail will introduce its Advanced Passenger Train (APT), which like the HST has a top speed of about 200 kph, but is capable of sustained speeds at 160 kph compared to the 144 kph of the HST. Moreover, the APT has a built-in hydraulic system which automatically tilts each car as it goes around a curve to provide equilibrium of force on the passengers. Hence, APT is able to negotiate curves 40 percent faster than conventional trains without significant modification of track. The APTs are aerodynamically





Artist's concept of a High Speed Surface Transport (HSST) to link Tokyo with the new International Airport 65 km. away in Narita.

shaped and have lightweight bodies of extruded aluminum.

Toward the close of this century, wheel-less trains suspended by magnetic forces or air will begin to make their appearances and change rail transport drastically. Prototypes of these trains are already running in Japan, France and Germany. According to Kunio Miyazaki, deputy director of the development department of Japan National Railways, magnetically levitated transportation opens various possibilities depending upon the kinds of linear motors utilized and the methods of levitation used. But basically, magnetic levitation (mag-lev) trains are floated several centimeters above a guideway through the use of magnetic force.

As with other high-speed trains, Japan is leading the way in development of mag-lev trains. Japan National Railways has a seven-kilometer test track at Miyazaki Prefecture, and tests are being conducted there to stabilize the average running speed of the prototype mag-lev train at 400 kph, with attempts being made to reach 500 kph. Japan Airlines (JAL) has constructed a test mag-lev line of 1600 meters on Higashi Ogijimi, an artificial island in Tokyo Bay. JAL plans eventually to construct a mag-lev train from the new Narita Airport to downtown Tokyo, a distance of 66 kilometers. The decision to use a mag-lev type vehicle was made in 1974. A grant from the Japanese government has allowed JAL to begin construction of a prototype train capable of carrying 80

passengers. The prototype has the shape of a wingless jet aircraft and is expected to be 23.2 meters long, 3.8 meters wide and will have a fuselage depth of 3.1 meters. It would be ready for testing in 1980.

JAL projects that a fully operational commercial mag-lev system from Narita Airport to Tokyo could be a reality within three years of completion of tests, but it will probably take longer than that. One formidable obstacle is cost. JAL now estimates that a double overhead track, without land costs, would amount to about \$10 million per kilometer.

The proposed train would eventually carry 224 people at an average speed of 300 kph. Propulsion would be by linear induction motor, and levitation and guidance would be accomplished through attractive electromagnets.

Although the JAL is one of the mag-lev trains closest to actual passenger operation, other mag-lev prototypes are in existence. In addition to the seven-kilometer test track at Miyazaki, work is being done in Germany on the Transrapid 04, a linear induction drive that rides on an electric magnet cushion.

In France, an air-cushioned train is being developed that runs on a monorail type vertical center guide beam. A seven-kilometer guideway has already been constructed near Orleans for the Aerotrain prototype. Fans are used to lift the train and give it lateral guidance. A propeller driven by two high-powered gas turbines provides the propul-

sion. Speeds up to 290 kph have been recorded on the 80-passenger prototype. Eventually the test track is expected to be incorporated into a 110-kilometer route between Orleans and Paris.

A similar tracked air-cushioned vehicle is also under consideration in Britain. This vehicle, however, is expected to be propelled by a linear induction motor. It is expected that in the next couple of decades Europe will be criss-crossed by 200-passenger wheel-less trains that can move at speeds of 400 kph or more.

Even faster is a rail system being touted for this country by Robert Salter, head of the physical sciences department at the Rand Corporation in Santa Monica, California. Salter has plans for a subterranean train that could conceivably travel from New York to Los Angeles in 21 minutes, reaching 22,400 kph (14,000 mph).

Salter furthermore contends that the system, which he has dubbed Planetran, could eventually be hooked into similar systems in Europe, Asia and Africa through under-ocean tunnels. A science-fiction film made in 1935, *The Tunnel*, did explore the possibility of a sub-Atlantic tunnel and train. But so far, a tunnel has not even been dug under the English Channel—a project first proposed by Napoleon.

Still, Salter contends, "No scientific breakthroughs are required for Planetran. Critical areas include tunnel alignment, vehicle lateral acceleration, vehicle control and

damping, and the tunnel process itself. Technology for these and other development areas for Planetran already exists."

In the proposed Planetran system, cars travel in underground evacuated tubes and are electromagnetically supported and propelled. They would be continuously accelerated to midpoint (now projected to be Dallas) and continuously decelerated from there.

Salter contends that with properly positioned seats, passengers would feel the propulsive forces only as additional weight. At the start and finish, they would feel approximately 40 percent heavier, and at midpoint, only slightly heavier. The one-g force felt at maximum speed could be reduced by a third by slowing the movement of the trains and adding extra stops.

Feeder lines would enter the main transcontinental line at two interchange points—Dallas and Chicago. Subsidiary lines from the four main terminals (including New York and Los Angeles) would join from such places as San Francisco, Boston and Detroit.

Air travel would be reduced along the Planetran route, but would continue to serve vast areas of the country where lack of sufficient population density would preclude Planetran use. And Planetran could be hooked into the airports via local feeder subway trains.

In addition to being incredibly swift, Planetran would also be a significant energy saver versus current forms of transcontinental travel. Salter estimates that coast-to-coast energy costs would amount to less than one dollar per passenger.

Cars would contain cryogenically cooled supermagnets for levitation. Traveling electro-magnetic waves in Planetran's guideways would oppose the magnetic fields in the cars to provide both support and forward/reverse thrust. For every car that is being accelerated in one direction, there would be another in an adjoining tube decelerating in the opposite direction. The decelerating cars return electrical energy to the system.

Locating the trains underground would reduce negative impact on the environment not only for the trains themselves but also for other systems of material transport. Pipelines for oil, water, gas, waste disposal and even slurries of materials such as coal could be located in the same tunnels. Communications links, including fiber-optic channels for lasers and microwave guidelines, as well as more conventional power transmission links, could also share the tunnels. Multiple use of the tunnels could help reduce right-of-way costs, decrease surface congestion and eliminate noise pollution, Salter contends.

Construction of the tunnels for the proposed Planetrans would be the most problematic engineering feat and also the most costly factor in the system. Salter estimates that digging the necessary tunnels could cost over \$100 billion at today's prices.

The tunnels must be placed at least a hundred meters underground in solid rock formation. In most cases, depths of more than a mile may be required. New tunneling tech-

niques would be backed up by tunnel-boring machines, water-jet drillers, hypersonic projectile spallation, and laser and particle beam devices.

Of special interest is a drilling system that utilizes a heated tungsten probe to literally melt its way through igneous rock. The system, called Subterrene, has been developed by Los Alamos Laboratories in New Mexico. It has been proved a viable tunneling technique, and though Los Alamos has discontinued research on the project because of lack of funding, Subterrene could be resurrected and utilized—possibly using a nuclear heat source.

One particular advantage of the Subterrene method of tunneling is that the rock matter on the sides of the tunnel become fused from the intense heat to form a hard glossy shell that is practically self-shoring.

The shelling of the vacuum tube, however, is still expected to be lined with pre-stressed, high-strength concrete and then coated with irradiated distributed polymers. The 10,000 psi concrete is considered dense enough for vacuum purposes, but the plastic glaze coating will be added for extra protection.

A major problem (in addition to tunneling) involves lateral acceleration. According to Salter, cars at speeds of several thousand miles per hour must maintain a very precise course to avoid excessive sideways forces on passengers. At the maximum speeds being considered, bending radii must be greater than 800 kilometers. Since Planetran is using magnetic fields as its tracks, exacting control of the fields is crucial.

Extremely accurate "shimming" of electromagnetic power by minute computer-determined vernier currents is essential. The recent development of compact, reliable, low-cost micro-computers paves the way for such control systems, says Salter.

Hundreds of these computers could be distributed along Planetran's electrical guideway structure to signal any tiny changes detected by specially placed detectors. Even in the event of an earth tremor, this control

system could keep the magnetic guidefield in a fixed position. The vacuum tube would also be supplied with a system of rollers, servos and compliant joints to "ride with the punch" should a major earthquake occur.

Passenger safety has not been overlooked in the event of an emergency stoppage. Provisions have been made for this and other problems, says Salter, in the overall design of operational and car life-support apparatus, quick-opening computer-controlled gates at tube ends, terminal handling networks, tube vacuum pumping and sealing and control system diagnostics.

'Airbag-like attachments at either end of the Planetran car partially inflate in the vacuum tube to reduce longitudinal air flow. These same bags, fully inflated, would serve to seal off a portion of the tube in the advent of an emergency stop for the vehicle. Periodically placed hatches in the tube wall would permit passenger emergency exit from vehicle and tube.

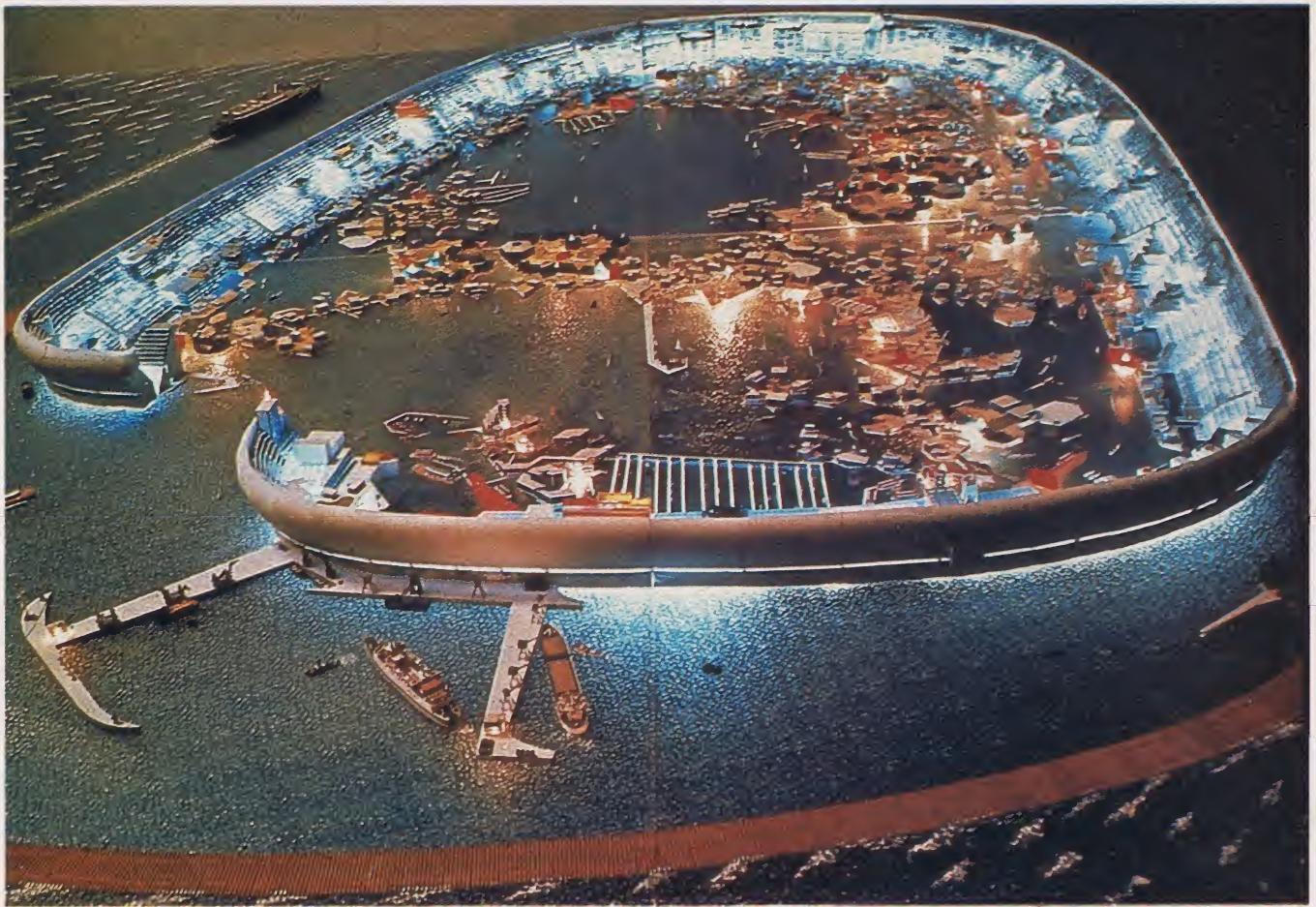
Salter believes Planetran is not only technologically feasible but economically feasible as well. The projected cost of the high-speed portion is now pegged at \$250 billion, including \$185 billion for tunnels. But these costs can be quickly amortized, Salter contends, from revenues generated by the system. With 200-passenger cars going in both directions on one-minute headways and an assumed fare of only one dollar per minute, that's a revenue of \$182,400 per minute, or \$96 billion per year.

Though Planetran may be decades away, the advantages of the system—which provides rapid transit coast to coast while eliminating or reducing both ecological problems and fuel consumption—are too numerous to be dismissed out of hand.

Vehicle travel along fixed guideways—although it may not be developed from currently proposed systems and surely will not be with the metal rails we know today—is definitely one of the most effective and efficient modes of travel for the 21st century and beyond.



Japan Air Lines' HSST-01, the first test vehicle which will test speeds up to 300 km/h.



# Sea City

An innovative proposal for a habitat of the future designed to solve some of the problems of today

By ADAM STARCHILD  
and JAMES HOLAHAN

**S**ome of the world's most articulate scientists, politicians, economists and sociologists appear to have joined together in a school of thought, the purpose of which is to forecast doom in a world that they see as overpopulated, overpolluted and undersupplied with the natural resources needed to maintain the high level of energy requirements for a burgeoning world population. Not only are we critically short of the resources for a world energy supply (they say), but we are also facing an impending world food shortage, the likes of which boggle the imagination. One prominent science writer has projected a cut-off date of 50 years hence, at which time he envisions great hordes of people leaving the cities, swarming across the land like locusts in search of food.

To the believers of this creed of doomsday, the entire concept seems endowed with an aura of inevitability; just as with the weather, it is coming, and there is little that anyone can

do about it. Fortunately, however, in the case of doomsday, a few people around the world are doing something.

Take the Pilkington Glass Company of England, for example.

The Pilkington Glass Company's dream for the not-too-distant future is an island of concrete and glass that could be constructed in the shoals (shallows) of the oceans around the world. This is envisioned as being not only largely self-supporting, but also capable of producing goods for export to the nearby mainlands. It is designed not merely as an industrial project, but as a city that could house and provide food, utilities, education, medical facilities and recreation for a population of some 30,000 persons. The name chosen for the model of this futuristic appearing island city is, aptly, Sea City.

Since oceans cover three-fourths of the world's surface, with approximately 10 percent of this area consisting of shoals, the ideal

topography for Sea City is widely available. Some suggested areas that would be suitable are: Martha's Vineyard (off the coast of southeast Massachusetts); extensive areas of both the Yellow Sea and the East China Sea; off the coast of Israel, as well in the oil-producing Persian Gulf; off the South American coast, extending from the vicinity of Rio de Janeiro southward to the River Plate; in the Gulf of Mexico; and large areas from the Java Sea northward to the Gulf of Siam. The Baltic Sea around Europe contains large shoal areas, as does the northern half of the Adriatic Sea, between the coasts of Italy and Yugoslavia. The North Sea, Black Sea and Irish Sea could all provide shoal areas for Sea City.

At this writing, Sea City is somewhat more than just an idea. Design details have been developed by its designers, architect Hal Moggridge, climatic and ocean engineer Ken Anthony, and structural and civil engineer

John Martin. An artist's concept of the project has been developed and photographed. Not only do its enthusiastic supporters see this island city as a functional economic unit, they also see it as providing an aesthetically pleasing, warm and healthy environment for its inhabitants.

According to the artist's concept of Sea City, if you were to view it from a helicopter you would get the impression of a huge amphitheater with tiered "bleachers" extending from the base of the amphitheater rim to its top. This amphitheater design allows the structure to encircle a sheltered lagoon that contains clusters of artificial floating islands. The "bleachers" of the main structure are in fact storied apartments and industrial buildings, with the entire tiered section of the main structure comprising 16 stories. Access to the inside of the amphitheater is gained by an opening that faces toward the mainland shore; this opening is in effect a harbor entrance to the inner lagoon. The actual, physical size of the amphitheater is projected as being 4,700 feet from north to south, and 3,300 feet across at its widest point. The city is afforded protection from sea breakers by an encircling breakwater on the seaward side.

The construction techniques of Sea City will follow the traditional methods that have been developed in bridge building, etc. The initial step of the construction is the driving of piles (precast and barged from the mainland) into the seabed at 20- to 30-foot intervals. Next, deck sections of reinforced, precast concrete are towed to the site, where they are jacked up onto guide rails between the rows of piers. These deck sections are locked in place on the piles to form a continuous cellular slab. To complete this foundation,

concrete is poured to fill the voids around the pile structure.

The next construction phase of this main amphitheater structure is the placing of prefabricated concrete cells on the base. Those cells, prefabricated on the mainland, are transported to the site in bottomless barges, where they are to rest on the base, starting at a point 30 feet above the highest anticipated level of the sea. The cells are winched up temporary ramps onto the base, where they are mounted one above the other on spacer units. Each cell forms either a small flat or a portion of a large one. The spaces that surround the four sides of the cells are used as conduits for gas, water, electricity and sewage. To finish the main structure, each cell is stressed down to the one below to form a uniform, massive structure.

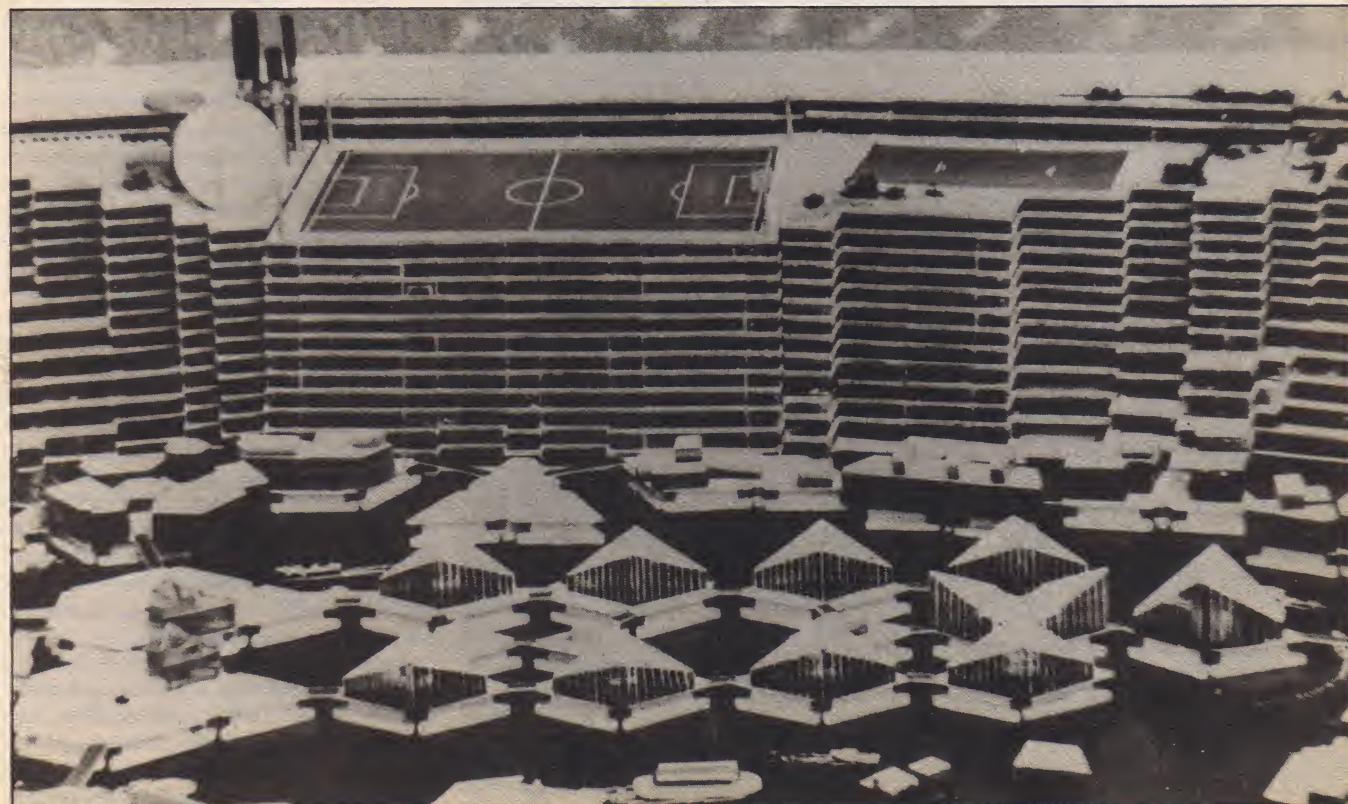
To utilize the sheltered lagoon to its fullest, islands are constructed in it which provide a base for everything from housing to playgrounds for children and industrial facilities, with a network of connecting pathways between the islands. The islands of the lagoon are triangular concrete pontoons, 60 feet wide, and held in position by anchor chains. The rigid sections, which are linked together by flexible couplings to allow for the movement of the water, form a modular type of construction, which allows the islands to be uncoupled and recoupled in various combinations to form islands of various shapes and sizes, up to 10,000 square feet in area. The top platforms of the island, which overlap the pontoons, support lightweight, fiberglass reinforced plastic buildings of up to three stories in height. The pontoons, which contain buoyancy compartments and storage areas, are equipped with ballast tanks that

can be flooded or pumped out to level the rigid sections with each other, regardless of the load bearing on them.

If Sea City is to function as the designers envision it, it must do so in an artificially warmed, climatically controlled environment, protected from any wind or rough seas that might occur. The protection from the sea is afforded by a breakwater which is constructed seaward of, and around, the city. This breakwater effectively creates a trench or "moat" of calm water that surrounds the outer perimeter of the amphitheater. The breakwater is made up of 100-foot-long by six-foot-diameter bags, filled to 90 percent with fresh water, and anchored side by side with flexible cables. When an incoming breaker strikes the breakwater, a secondary wave is generated inside each bag, which rebounds against the end of the bag and creates a damping action against the incoming sea breakers.

As further insurance that the inner lagoon of Sea City remains calm, a curtain of compressed air bubbles up from an undersea pipeline, rising to the surface across the harbor, or lagoon entrance.

Protection from winds is created by the structure of the amphitheater itself. In tests conducted at Leicester University, it was found that the optimum shape of the 180-foot-high wall would be that of an outward leaning figure "S." The wind tunnel experiments indicated that such a surface would deflect the wind upward to a height that would leave the area below relatively calm, resulting in a large, slow-moving vortex of air that moves back toward the direction of the wind, causing the air that passes over the terraces on the inner surface of the wall to move



Artist's rendering of Sea City shows a full-size football field on top of power complex, with marine zoos in foreground.

slowly upward. The tests further indicated that this slow-moving air mass will extend for some distance across the lagoon and will be maintained there by the thermal currents generated by the warm air mass that emanates from the mainland city.

The original plans for Sea City call for it to be located near a natural gas field. The gas will be piped to a processing plant on one end of the city, from where it will be fed to high-speed turbines that are coupled to electricity producing generators, to supply the electrical needs of the island city.

The essence of the success of Sea City is *conservation*, and to this end, the heat from the turbine exhaust gases will be used to provide energy for a desalination plant, as well as for domestic and industrial heating and refrigeration. The coolant water of the generating plant, the temperature of which will be raised considerably in the process, will be dumped directly into the lagoon, thus raising the temperature of the lagoon water an anticipated five to seven degrees above that of the surrounding ocean water.

To keep the heated water within the lagoon, where it will help in the maintenance of the artificially warmed climate, sluice gates will be installed beneath the supporting base platform. In good weather, the sluice can be opened to allow the natural tidal currents to cleanse the lagoon.

Sea City can be expanded in the future with no major technical problems to overcome, as new terraced walls can be built outside the main structure, and concentric with it. Such a design would create more lagoons of heated water.

The terraced section of the amphitheater comprises 16 stories of apartments that are centrally heated and/or air-conditioned, and will provide housing for 21,000 of the anticipated 30,000 residents of the city. Other residents will live in individually designed houses on the island of the lagoon. To avoid monotony in design, the format and size of the apartments are varied, with some apartments having up to seven rooms. Most of the apartments will be provided with terraced gardens. The apartment windows facing the lagoon are designed to give the residents at least two and a half hours of winter sunshine a day. The seaward side of the lower eight stories of the main structure will be used for offices and industrial facilities; the seaward side of the upper eight stories also have windows facing seaward.

Access to the city's gardens, shops, clubs, restaurants, etc., will be by escalators, travelators and covered walkways. The internal distribution of goods will be done by a network of pneumatic tubes and conveyors. The glass of the various structures will have a variety of special qualities, including tinting

for aesthetic appearance, as well as heat and light transmission and insulation properties to reduce glare and solar overheating. These factors should produce a comfortable, pleasant environment for Sea City residents.

To reduce noise, as well as pollution of the lagoon, all the internal transportation will be by electrically powered boats and water buses, with battery recharging units placed around the city to replace the familiar land-based "service stations." As planned, a five-minute water bus service can complete a circuit of the city in 25 minutes. There will be a one-way traffic system around the base of the terraced wall, where it is anticipated that traffic will be heaviest. Elsewhere in the lagoon, persons can travel at their own discretion. Landing islands will service those boats that are not moored beneath the terraced wall. Concrete landing pads are spaced around the lagoon, and boats can also be boarded by way of watertight doors in the sides of the pontoons, or from outside stairways.

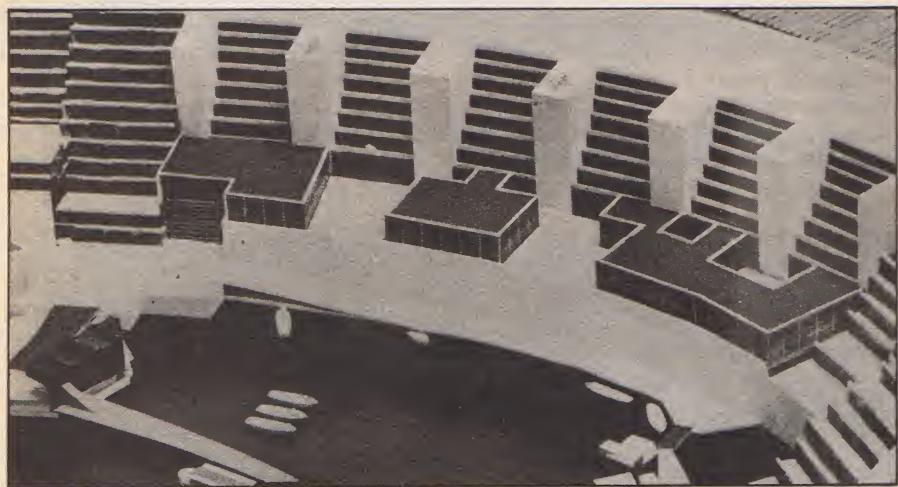
To avoid traffic congestion in the inner lagoon, visitors will be required to moor their boats at the berths provided near the lagoon entrance. Supply barges and container ships will bring supplies to the city, where ample storage space will be available; however, even in the event of a natural disaster the city would not be cut off from supplies, because hovercraft have already been developed that can travel safely at 30 knots in strong winds, over 10-foot waves.

Commuters will travel between Sea City and the mainland by hovercraft or helicopter-bus. Storage space for commuter autos will be provided in the form of a multi-deck parking garage on the mainland, and travel from there to Sea City's heliport would take 15 to 30 minutes by helicopter-bus.

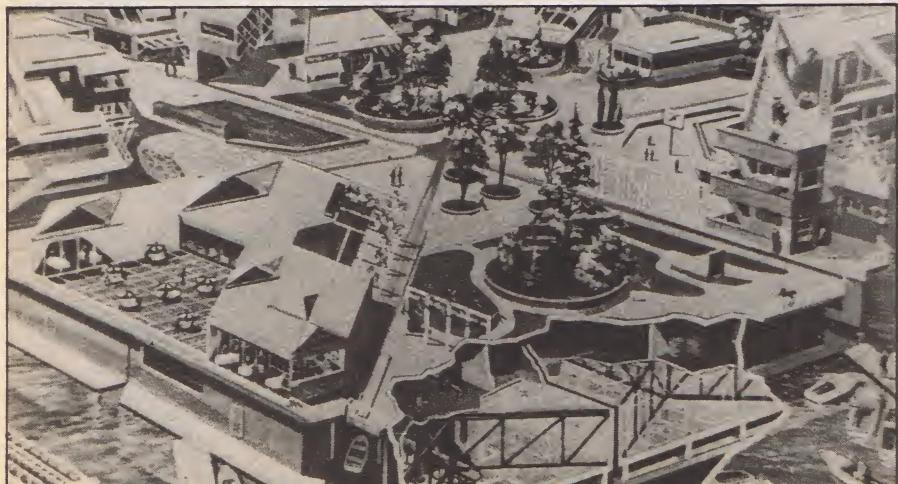
Just as any land-based city, Sea City will be internally self-governing, with the local government center located at the social hub of the city. Many of the public buildings, such as the nursery, primary and secondary schools, etc., will be located on the floating islands. None of the shops, schools or other facilities will be more than a one-mile walk by way of a network of footpaths and bridges, 13 feet above sea level, connecting the floating islands to each other and to the terraced wall.

Sea City will be serviced by a 200-bed hospital, clinics and dental services. Mortuary services will be in the form of a crematorium which is located just outside the city wall. The city's internal communications system will allow the residents to call for fire, police and government services exactly as we do now in any land-based city. To link the city's communications system to that of the rest of the world, an underwater cable to the mainland will connect into the world telephone and telegraph system.

To provide social and cultural facilities for the residents, there will be community centers, youth clubs, tea-gardens, two theaters, movie houses, libraries, an art gallery, a museum, and churches for all denominations. The City will maintain public gardens with flowers and shrubs chosen



Sea City's population would require a 200-bed hospital.



One of the large islands of Sea City, with cutaway showing flood tanks, buoyancy chambers and storage space in pontoons.

especially for the warm climate.

Sports-minded residents from children to adults are considered in Sea City's plan, with the central part of the lagoon being the hub of water sports. Weekend sailors, water skiers, and swimming and diving enthusiasts will actually be able to enjoy their sports year round because of the artificially warmed climate of Sea City. There will also be a tennis court, as well as a full-sized football field, on top of the power complex.

As desirable as all of these amenities of living may seem, the reason for Sea City's existence is not relaxation and pleasure, but *productivity*. The sea has for eons been the catch-basin for minerals that leach out of the soil and are carried to the oceans in streams and rivers. We know that life proliferates in many forms in the oceans, and moreover, that more natural resources must lie beneath the sea bed than we have yet tapped under the land. The very water of the oceans is the essence of life on Earth. Oceanography and undersea study is coming of age, and should form a basis of marine industry of the future.

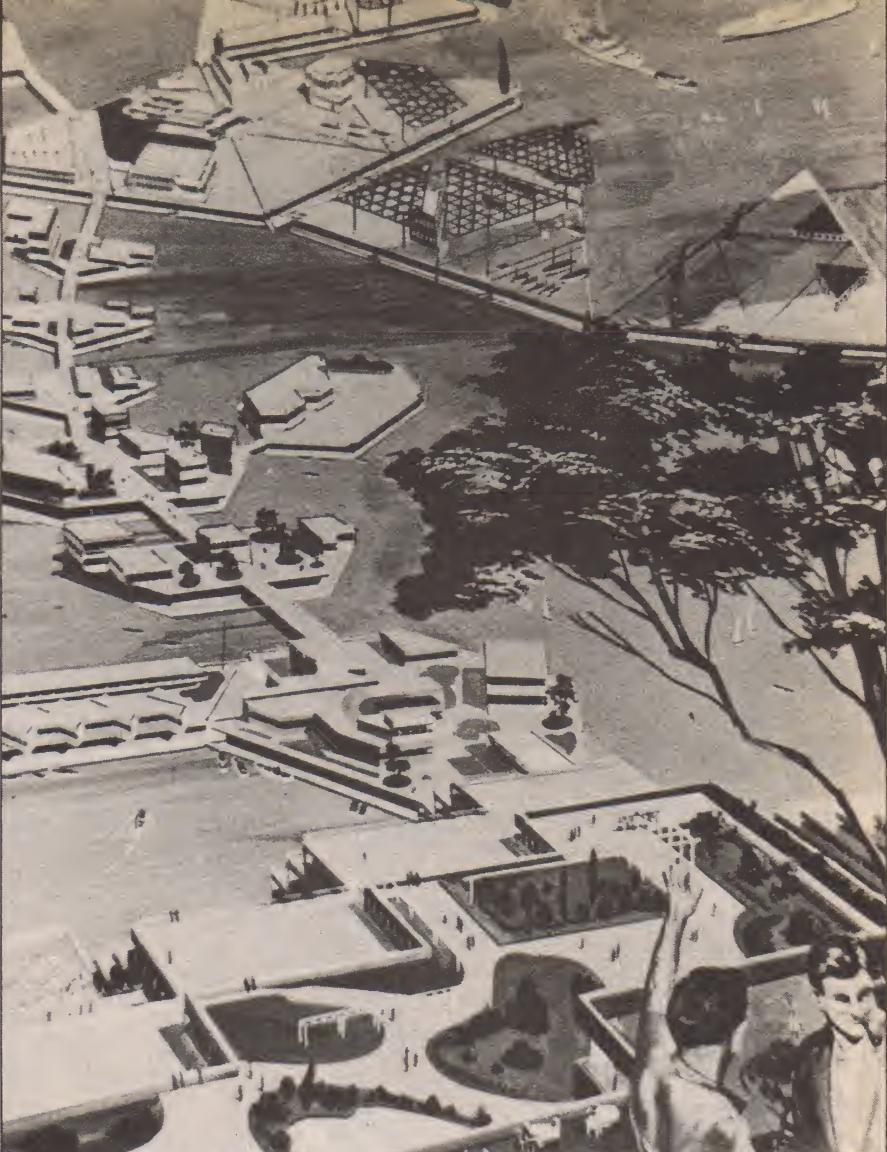
The Sea City prototype should be extremely important to the development of a host of marine industries. It could house a College of Marine Studies, complete with submarine laboratories and a marine zoo with observation posts, as well as research vessels. Such a college is seen as a first step toward a University of the Sea. The industrial and economic possibilities are far-reaching and dramatic:

**Boat building:** In recent years the sales of boats, both commercial and pleasure, have risen steadily. Sea City's lagoon facilities are easily adaptable to the industry of boat building, an industry which could contribute significantly to its economy.

**Sand and ballast dredging:** Land-based construction has a voracious appetite for sand and ballast, creating the possibility of a dredging industry for Sea City.

**Minerals and metals:** Sea water contains useful minerals and metals. Admittedly, the concentrations of these elements is low, but the recoverable amounts are quite large. For example, sea water with a salinity of 3.433 percent contains 1,272 p.p.m. (parts per million) of magnesium (used in the manufacture of optical mirrors, precision instruments, etc.). Bromine (used in the manufacture of pharmaceuticals, dyes, etc.), which occurs in sea water at about 13 p.p.m., was commercially extracted as long ago as 1924. Further, such metals as strontium (used in fireworks, flares, etc.), rubidium (resembles potassium and is used in photoelectric cells, etc.), copper and other metals can be recovered from sea water, as well as nodules of manganese dioxide that are found on the sea bed. Precious metals, such as gold, could be extracted from the brine concentrate of the City's desalination plant. The power complex could produce a by-product of nitrogen, resulting from free nitrogen extracted from the air, which would lead to the development of new fertilizer and chemical plants.

**Organic fertilizers:** Another source of income for Sea City would be from fertilizers



View from an upper terrace shows playgrounds and chain of islands.

manufactured from seaweed and sewage.

**Water:** The large desalination plant that is planned for the City would enable it not only to provide its own fresh water needs, but also pipe water to the mainland, where formerly arid land could be turned into orchards and gardens. Undoubtedly, when enough island cities such as Sea City exist, viable methods of transporting water for long distances to interior regions will be developed. The production of water alone would justify the existence of Sea City.

**Food:** Water is the natural environment for man's most nutritious and plentiful—but perhaps least exploited—food: fish. Commercial fishing, as it is generally practiced, is a somewhat inefficient way of harvesting the bounty of the oceans. Fish *farming*, on the other hand, is becoming recognized as one of our most efficient methods of producing high-quality food, because fish have an extremely high conversion ratio of feed consumed to meat produced. And the warm-water environment of Sea City would be ideally suited to the culture of almost all the fish that we traditionally buy in the markets, including most of the "flat fish" (ling-cod, sole, etc.) as well as trout, salmon, shrimp, etc. The culture of oysters, clams, and other

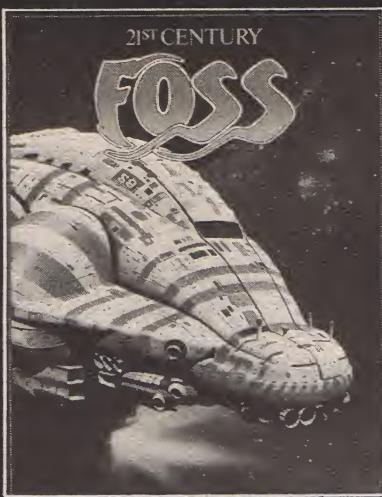
shell fish would undoubtedly be successful.

A major advantage of this kind of food production, which combines the best of both artificial and natural environments, is the speed with which fish feed can be converted to food for man. In temperature-controlled tanks, with intensive management, and with a fish feed that could be processed from such waste products as sewage, the yield from Sea City fish farms should equal, if not exceed, the productivity of any warm-water pond now in operation in America or Europe, where a pond-acre normally produces something on the order of five tons of fish per year. And such a farming enterprise would tie in with the industry of fish canning.

The operation of Sea City's many industries and services will provide employment not only for Sea City residents, but also for workers from the mainland.

How long before the Sea Cities of the world become reality? The answer to that question cannot be easily arrived at. We know that the technology for such a project is available—the Pilkington model has proved that. Now it remains for some entity—governmental, corporate or a partnership thereof—to commit to an investment in Sea City; an investment in the future. F

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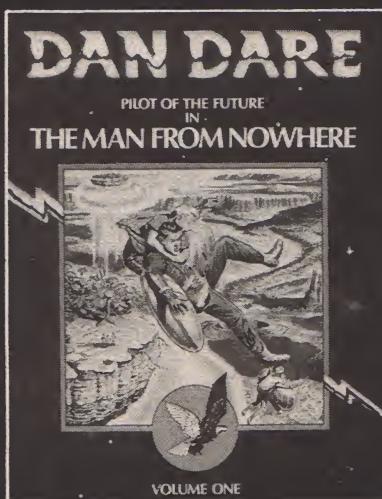


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## Forests: Seeing Them for the Trees

If a tree fell in the middle of the forest and no one were around to hear it fall, would it make a sound? This is a stimulating philosophical discussion, but in ecological terms the answer is a resounding, loud-and-clear yes. According to some experts studying the status of forests, there are far too many trees being felled and the sound is one being heard—and felt—throughout the world.

The last official inventory, completed in 1963, estimated that 29 percent of the Earth's land surface is forest, in one form or another. More recent analyses put the mark at approximately 20 percent for closed (thick) forests and 12 percent for open (scattered) forests.

Lately, timber has been in the news, as energy-conscious Americans stoke up wood-burning stoves in an effort to beat skyrocketing heating oil prices. This back-to-basics movement seems somewhat... basic—considering that about half of all the wood cut in the world each year is burned as fuel, mainly by the one-third of humanity which still depends on firewood for cooking and heating.

Forests also provide such human amenities as raw materials for houses, furniture, paper, medicines and even plastics. As an ecological agent, a forest helps the flow of water, oxygen, carbon and nitrogen. Trees hold soil on mountainsides and provide homes for virtually millions of plant and animal species. And there will never be a substitute for a walk through the woods or the grandeur of a 1,000-year-old redwood tree.

What it ultimately comes down to is that we are all directly in need of forests. As humans continue to populate the planet, more and more of these forests are disappearing, and unless deforestation is checked, some catastrophic situations will arise.

Nowhere is this fragility more apparent than in the tropical rain forests, of which 27 million acres are annually cleared for commercial endeavors. Reports the National Science Foundation: "If something is not done to curtail the destruction of tropical rain forest ecosystems, the webs of life that define them and limit or prescribe what can be produced... will never be known."

Considerable attention has recently been focused on the lush Amazon Basin of Brazil (though a total of seven nations border the basin)—the world's largest rain forest and the world's longest river. With all its largeness, it's no wonder that the same adjective applies so aptly to its problems. This once-impenetrable jungle is now the apple in the eye of many a developer, farmer and logger. It is estimated that an area the size of Indiana was cleared in the Amazon last year. Aside from the loss of trees, consider that probably a million other species share the same forest.



A worker carries seedlings to replant the cleared Brazilian rain forest.

Daniel Ludwig, who ten years ago set out to tame three and a half million acres of the rain forest. Today, Ludwig's empire, Jari, is a tribute to 20th-century can-do-ism. Using sophisticated methods, Ludwig cleared and replanted miles of native forests with more commercially valuable species; vast expanses of swampland have been transformed into thriving rice paddies. Jari boasts an impressive floating pulp mill the size of a 150,000 ton ship.

Admittedly, Ludwig's empire is an awesome accomplishment. Yet it is the wholesale transformation—total human manipulation of a virgin rain forest—that has some environmentalists fretting. After all, the Amazon generates one-fifth of Earth's oxygen and plays a major role in global weather. Is all this mucking around going to catch up with Ludwig's grand experiment?

The challenge of wise utilization of forest lands is especially poignant in developing nations, where the immediate needs of struggling populations often overshadow long-term ecological considerations. Eighty percent of the wood used in Third World countries is burned for fuel. These people know little about reforestation, nor do they realize that the denuding of forests leads to erosion, desertification, flooding and the extinction of species. It is ironic that nations so rich in timber are so lacking in economic and ecological capabilities to deal with it.

Like it or not, the future of forestry depends on the "haves" providing for the "have-nots." It is enough of a dilemma in America that as lumber prices rise, housing costs soar. But actual day-to-day existence is directly linked to forest for a majority of the world.

There are some encouraging signs of change: During his first six months in office, Brazil's President Joao Baptista Figueiredo has created three national parks in the Amazon; the newly formed Amazon Forest Policy Committee has recommended the creation of 600,000 square miles of national parks and ecological preserves, and another 300,000 square miles as national forests. Furthermore, the government in Brazil is curbing the corporate exploitation of the rain forest that they so strongly encouraged in the past decade. Similarly successful reforestation programs are underway in China, Pakistan and other developing nations.

But someone is going to have to foot the bill. Many Third World countries feel that if the entire world is so dependent on their forests, the entire world should pay to preserve them. Considering the gravity of the consequences, now is the time for wealthy nations to start investing in the future greening of Earth.



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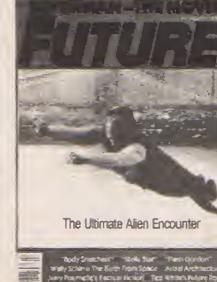
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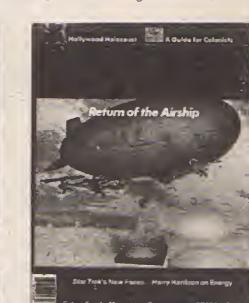
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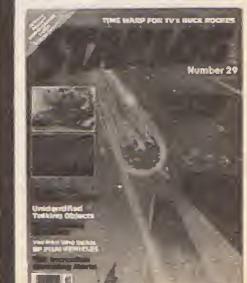
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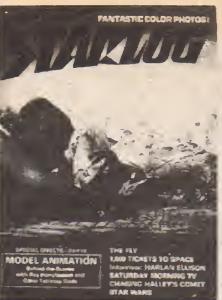
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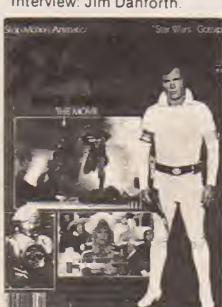
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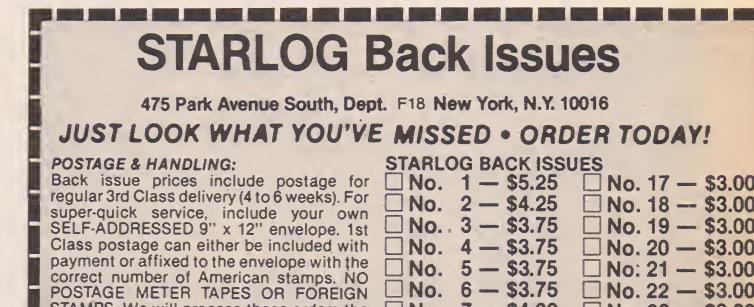
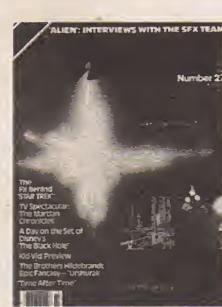
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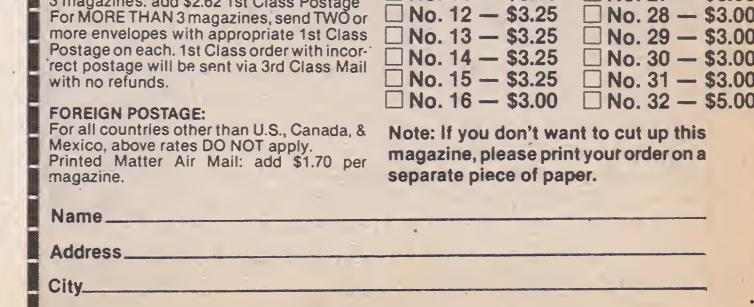
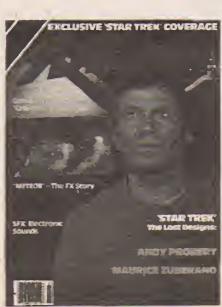
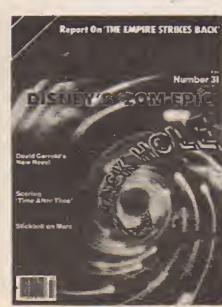
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# The Payoff from Space

Technology developed to move people into space  
has improved the quality of life on Earth

By ALLAN MAURER

Dressed in a miniature spacesuit, a Houston child named David stepped from a sterile plastic bubble into the outside world for the first time three years ago. Born with severe immune deficiency, David does not have normal bodily defenses against disease; germs harmless to most people can kill him. Since receiving his NASA-developed spacesuit, David has been able to leave his sterile isolation chamber and live a more normal life.

David's story inspired the TV movie *The Boy in the Plastic Bubble*, starring John Travolta, and is one of the more dramatic examples of spinoff—side benefits from the American space program.

"We're bringing it all down to Earth," says Lou Mogavero, NASA's Chief of Terrestrial Applications. "Space Benefits," a recent NASA publication, details 500 applications of space science to government, industry, communications, education, transportation, manufacturing, health care, food production, energy and other fields."

In 1977, the Denver Research Institute reported that ten dollars are returned to the economy for every dollar NASA spends on spinoff. "That's an evaluation of performance, not a guestimate," says Richard McCormack, a NASA public affairs officer. But Floyd Roberson, director of NASA's Technology Transfer Division, is quick to point out, "That figure does not include what it cost to put a man on the Moon. It's an evaluation of how much it cost to get the information to the public."

More than money is involved, however, says Mogavero. "It's hard to put a dollar value on what we've done to help the handicapped live more normal lives, and in medical research, hospitals, and health care. These include such things as developing voice-operated wheelchairs, articulating robotics (jointed artificial limbs) and lightweight batteries."

NASA holds patents on 3,500 inventions available for commercial licensing, but Roberson agrees that space science applied to health care is impressive. "Shortly after I joined the agency," he says, "we visited Stanford University's Biomedical Applications Center. The doctor we were to meet was over an hour late for his appointment with us. Later we learned he had been in the operating room, removing a tumor from the brain of a young black fighter. We saw the NASA-developed intercranial pressure monitor used in his post-operative care. This brought home to me just how concrete and real technology transfer can be."

NASA is also bringing medical care home to the natives of Ka Ka, Hickiwan, Vaya Chin, and Gu Vo. These may sound like places in

Southeast Asia, but they are as American as Peoria—and almost as remote as astronauts in space. They are villages of the Papago Indian Reservation in Arizona, chosen to test a mobile health care and communications unit. The unit is modeled on NASA's plans to provide astronauts with medical care on long-duration interplanetary missions. Using special NASA communications equipment, a doctor can help patients without being physically present, whether the patients are in Papago villages or enroute to Mars.

Still another medical innovation developed through NASA research is designed to bring your stomach down to Earth. Motion sickness has annoyed people since the invention of the wheel, and boats, trains, planes and spaceships have added to the misery some feel when they travel. Searching for better ways to relieve astronauts suffering from motion sickness, NASA scientists found that a combination of two drugs works better than either one by itself. Further experiments may provide a long-term treatment which involves wearing a foil patch containing a drug and a chemical that enables it to penetrate the skin.

Spinoff applications of space technology are equally impressive outside the medical and health care field. The number of terrestrial uses found for spacesuit technology alone is startling. The material used to make the suits, Teflon-coated Beta fiber glass yarn, has revived an ancient and honorable shelter: the tent. Light, durable and nonflammable, this space-age material does not stretch, shrink, mildew or rot. It is strong, never needs cleaning because dirt won't stick to its slippery surface, and is 30 to 40 percent cheaper than conventional roofing materials. It is being used in a growing number of buildings, ranging from the Detroit Lions' Silverdome at Pontiac, Michigan, to a vocational school in icebound Alaska, and a recreational structure in the scorching Saudi Arabian desert.

Heated clothing for construction workers, hunters and skiers is another example of spacesuit spinoff. "Lunar gloves" which sell for \$30 a pair, boots, caps and goggles are commercially available. Thermaflex, a woven mesh material designed to allow air to flow around an astronaut's feet, is used for bicycle seats and athletic insoles.

Mogavero noted that spinoff has been used in the public as well as the private sectors of the economy. One of the most unusual applications of space science to a "public sector" problem is underway behind the crumbling walls of San Quentin prison in California.

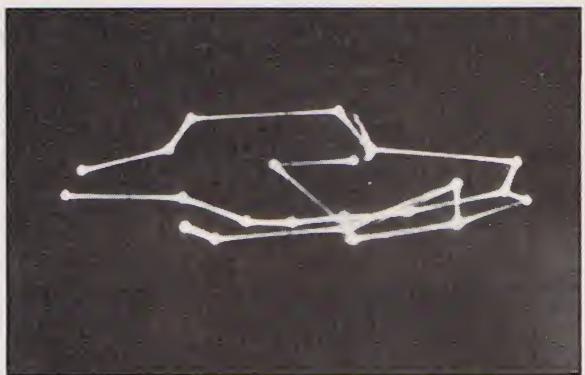
Violence reached unprecedented peaks in California prisons during the last decade, with over 500 stabbings and assaults that led to the deaths of 100 inmates and a dozen guards. At San Quentin, warden



PHOTOS NASA

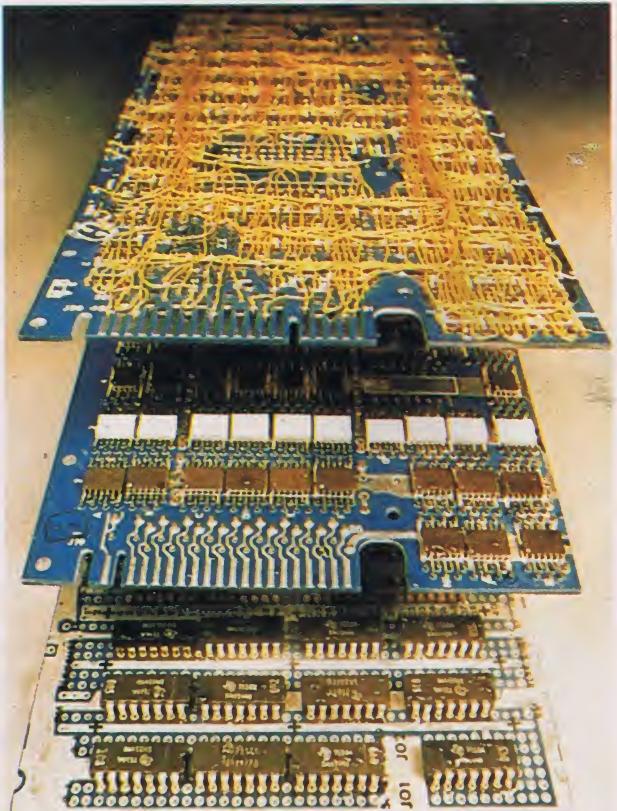
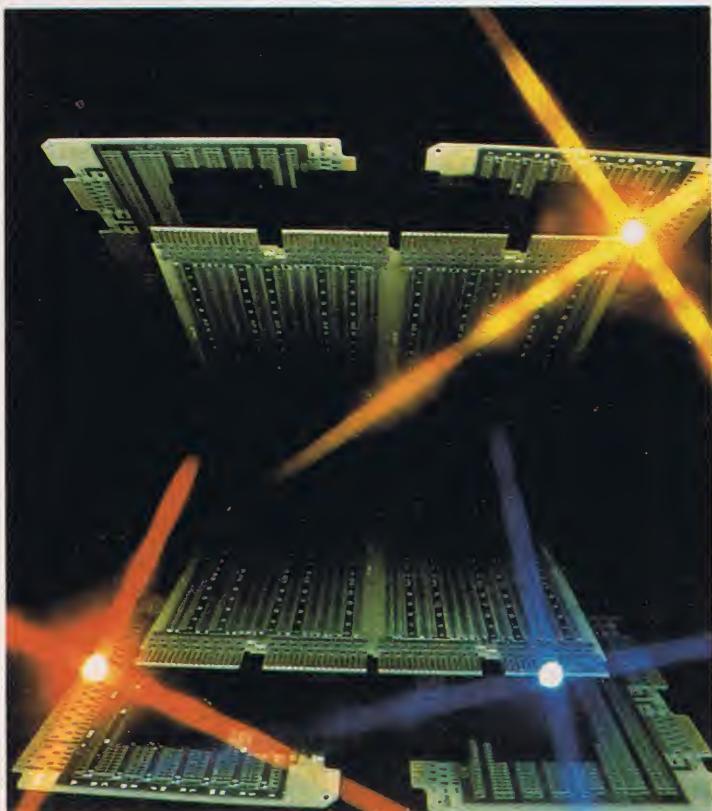


Technology developed for astronauts' spacesuits has been applied to many other purposes on Earth. Top: Teflon-coated beta fiber glass yarn is used for an updated tent structure. Left and above: Houston youngster "David," born with severe immunodeficiency, can live only inside his plastic bubble environment—or in the spacesuit designed for him by NASA.



PHOTOS NASA

Computer design techniques developed for aerospace construction have been adapted to passenger cars such as General Motors' Cadillac Seville, the first to benefit from the company's Vehicle Structural Analysis Program, now used in the design of all GM cars. Right: Lightweight oxygen bottles developed for the space program are now used by scuba divers and firefighters. Wound with 1670 miles of filament, the bottles are lighter, stronger and hold more volume.



The most pervasive spinoff of the space program can be seen in the advances in microelectronics made necessary by the need to keep all spacecraft components as small and light-weight as possible, yet sophisticated enough for spaceflight.

George Summer blames most of the outbursts on the activities of three prison gangs: a Mexican Mafia, the Black Guerrilla family, and the Aryan Brotherhood, a group of neo-Nazi bikers and thugs.

Recently, however, NASA engineers installed specially designed sensors and other technological devices which have lessened tension. One sensor, placed in cell walls, detects certain sounds over great distances. "We can determine if anyone is cutting on a bar, sharpening steel on concrete, or tunneling," Summer says. Another sensor allows guards to eavesdrop on prison yard conversations, and a third sounds a warning if anyone approaches within 20 feet of the perimeter fence. NASA-designed glasses permit the guards to see the yard clearly at night.

The prisoners, who might be expected to resent these Big Brother-like devices, apparently do not. They no longer have to worry about being stabbed because they are black or white or speak Spanish, Summer explains. "It's cooler, man," one prisoner said, "cooler."

The prisoners at San Quentin would probably be overjoyed to get their hands on a device jointly developed by NASA and the U.S. Coast Guard. A lightweight firefighting unit that can be carried by helicopter, it uses rocket engine pumps to deliver 2,000 gallons of seawater a minute to wherever it is aimed. NASA's Roberson describes it as one of the most impressive things he has seen.

"When I first saw it demonstrated during the handover ceremony at Boston," he says, "my first impression was of the high pitched whine of its engines and a long, lacy stream of water. Then I realized it

Computer graphic enhancement, developed to improve resolution of space photography, is employed by artists such as Howard Sochurek to create extraordinary visuals for fun and profit.



NASA technology applied to firefighters' needs has significantly improved protective clothing and hand-held equipment. Weight reduction lessens fatigue and reduces injury and disability rates.

was coming out with enough force to knock down the walls of a house!"

Firefighters have also benefited from a lightweight air bottle NASA designed. A Boston deputy fire chief told NASA officials, "Many men preferred not to use the older equipment. Without it they risked being overcome by smoke, but with the old masks the weight could make them collapse from heat and exhaustion."

Transportation is another area in which aerospace spinoff has had a major impact. The NASA/Army tilt rotor aircraft has wing-mounted helicopter rotors for vertical takeoffs and landing, but in flight, the rotors tilt forward to become propellers. The plane can cruise at 460 miles an hour. A specially designed NASA wing enabled construction of a smaller, lighter plane capable of greater lift than previous aircraft.

NASA helped develop a jetfoil for boats that lifts the hull out of the water and gives a fast, jolt-free ride even in rough seas. Called Hydrofoils, the ships which use this device are in service throughout the world, and have set speed records. A NASA-developed radar unit provides more conventional ships with a means to measure ice thickness and cut their way through frozen waterways.

Electric cars using nickel-zinc batteries developed by NASA are in use by the U.S. Post Office, and General Motors modeled its structural analysis program on a technique created by NASA engineers. GM used the program to design a smaller, lighter Cadillac Seville with the smoothest ride possible for its weight, and is applying the program to its full line of automobiles. NASA's own version of the same program, called NASTRAN (NASA Structural Analysis Program) played a role in giving Disney World visitors a cheap thrill: it was used to design the support structure for the Space Mountain roller coaster ride.

Chances are good that your own home contains examples of spinoff from space technology, too. A metallized plastic material originally developed for use in the Echo I communications satellite improves the shelf life of some foods 300 percent when used in packaging. A lubricant that served in a group of satellites is now commercially available as "Sound Off," which deposits a microscopically thin coating on records to keep the diamond stylus from gradually eating away the vinyl grooves.

Roberson believes that the most important benefit we have received from the space program is also the most pervasive and least noticed.

"The greatest single thing to come out of space technology," he says, "is the increased reliability of electrical components. Many of the dollars that went into the space program were used in testing components to make them reliable. Now it's so pervasive that we don't notice it, but I don't think we'd have solid state TVs that operate for five years maintenance-free without it."

McCormack, on the other hand, thinks that a device called the power factor controller will become increasingly important to energy conscious Americans in coming years. "Two of the most crucial considerations on a spacecraft are space and energy," he says. "If you can miniaturize things and cut down on the energy they use, those are two big pluses."

The power factor controller, he explains, attaches to the motor wires of industrial or household appliances. It allows only the energy the motor needs to get through, and in tests has cut power consumption by the appliances up to 70 percent.

Although Roberson said requests for NASA technology briefs are increasing, he noted that America is falling behind other nations in research and development. "The contracts we're giving out now simply are not as demanding," another NASA official said. "They don't require the innovation that was needed when the space program was in full swing."

"All of these real, solid, technological innovations are a good reason for getting back into space," said an outside consultant who works with NASA on a contract basis. "But there is another reason, and perhaps a better one. Ray Bradbury said it when we first put a man on the Moon. 'Space travel says you can live forever. Now we are able to transport our seed to other worlds. We can be sure that this miraculous gift of life goes on forever.'

"That," said the consultant, "may eventually be the most important benefit of all."



# Farside

The other side of the Moon offers the perfect vantage point from which to observe the universe.

By MICHAEL A.G. MICHAUD

**T**he Moon, hung high above us, was the natural first target for our extraterrestrial aspirations. Prominent, brightly visible, obviously round, its face marked by intriguing patterns of light and dark—it is a little world. Except for the sun, it was the only body in the solar system whose disk we could see with the naked eye; it suggested to us the shape of the planet on which we live. With the invention of the telescope, we saw its craters, its seas of hardened lava, even the shadows of its peaks. Yet it remained tantalizingly out of reach, until 1969.

Now we know the Moon first hand, having walked its ground in rib-soled boots, and crumbled its dust between our gloved fingers. It is a remote but familiar place, a barren extension of the Earth, like an iceless Antarctica.

But we have touched only one side of the Moon. The other is forever hidden from observers here, turned away from us by our own planet's gravitational stranglehold, which keeps the same side facing us throughout the month-long lunar revolution around the Earth. That other side is a symbol of remoteness and inaccessibility: the far side of the Moon. The Apollo astronauts who looked down on it as they orbited the Moon were cut off from Earth, in a cone of radio silence, isolated from all other humans; they were, for those minutes, the loneliest men alive.

Yet it is that very insulation from the Earth, by 2,160 miles of rock, which makes the far side of a unique value to us. It is the one place in the inner solar system not barraged by the electric noise of humans—the cacophony of AM, FM, short wave, radar and television that already crowds the radio astronomer's sky. There we can locate the most powerful tools of our astronomy, undisturbed by the atmosphere, the hydrogen geocorona, the light, or the radio signals of Earth. In the Moon's weaker gravity, mirrors can be made larger without distorting, and radio antennas can grow to giant size.

The geometric form of some craters on the



Spherical antennas placed in natural craters on the Moon will listen to the stars.

far side of the Moon is that of a natural bowl. These craters could serve as the sites for large radio antennas, similar in design to the Arecibo dish in Puerto Rico, but much larger in diameter than Arecibo's 1,000 feet. Or many antennas could be laid out in rows, like the array of radio telescopes proposed by scientists in 1971 to search for civilizations among the stars, and called by the eerie name: Project Cyclops. A lunar colony, an inevitable future step for a spacefaring humanity, could support the construction, operation, and maintenance of such an observatory. A study by the Stanford Research Institute suggests that the ideal location for these instruments would be near the center of the far side of the Moon.

A few decades from now, we may be able to see through our Earth-based telescopes the first evidence of our humanizing of the Moon. On the near side, there may be flashes of light, or glints off metal structures on the lunar surface or in orbit around our natural

satellite. Over the years, these signs of human presence may spread across Luna's face, points of life scattered over that barren land.

But farside, out of the sight of Earth, would be the land of quiet. There scientists would work in a carefully preserved stillness, facing outward into the celestial deep. There our telescopes could linger on an object for days at a time, instead of the few hours granted to astronomers on the rapidly spinning Earth. Enormous mirrors would silently collect the faintest traces of light, discerning objects farther and farther back in time, ever closer to the primordial explosion. Great radio ears would strain to hear the whispers of the stars, and perhaps the distinctive patterns of intelligent communication. Farside Observatory would be our most open window on the universe, humanity's unblinking eye on the cosmos, our most advanced listening post for energy and life. And building it would extend human civilization around the Moon, enclosing a new world in our grasp.

# THE GREAT FLASH GORDON REVIVAL!

An old fashioned, all-American science fiction hero is revived in a new-fangled, European-made, \$40 million super space opera.

By JOSEPH KAY

In 1934, Alex Raymond unveiled a comic strip creation that was destined to become part of 20th century Americana: Flash Gordon, stalwart swashbuckler and space traveler. This December, producer Dino DeLaurentiis plans to repack the original character in a \$40 million Christmas present to the movie-going public. Flash Gordon is heading for the silver screen once more.

In his first motion picture appearance since the classic Buster Crabbe serials of the '30s and '40s, Flash Gordon promises to live up to today's sophisticated screen standards by mixing traditional action-adventure with futuristic film effects technology. The screenplay, by Lorenzo Semple Jr., is faithful to Raymond's original pulp fiction format.

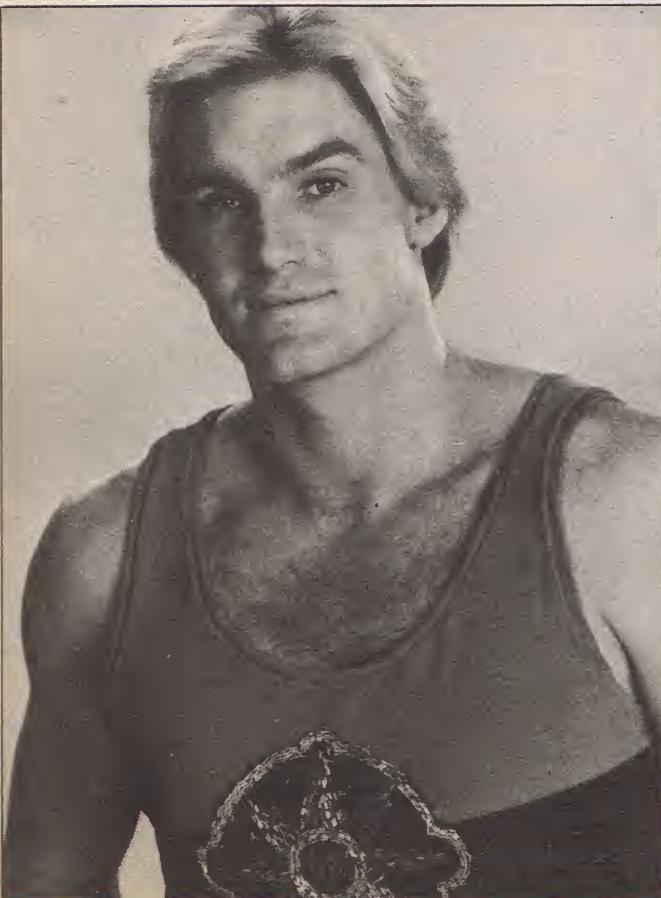
In the not-too-distant future, the American east coast wakes up one morning to find itself plunged into darkness. An unexpected solar eclipse has occurred! Scientists investigate the strange phenomenon and discover that energy beams of an unknown type have pulled the Moon 12 degrees out of orbit.

Only discredited NASA nuclear scientist Dr. Hans Zarkov (Chaim Topol) realizes the true extent of the danger involved. His homemade computer system warns that, within ten days, the Moon will smash into the Earth.... completely destroying the planet! Zarkov

traces the rays to their sourcepoint . . . the far-off planet Mongo. In a desperate attempt to save the world from calamity, Zarkov forces football hero Flash Gordon (Sam Jones) and friend Dale Arden (Melody Anderson) into his homemade rocket ship and off through hyperspace they go.

Arriving on Mongo, they encounter a world filled with strange alien citizens and even stranger alien landscapes. On and around Mongo they explore the forest Kingdom of Arboria, The City in the Sky (home of the Hawkmen), the frozen land of Frigia and the watery world of Aquaria, the land of the Lizard people. Before they finish sightseeing, however, they collide with the forces of evil on Mongo, led by Emperor Ming the Merciless (Max Von Sydow). Cheerleading for menacing Ming are his equally evil daughter Princess Aura (Ornella Muti) and the very villainous Klytus (Peter Wyngarde) and

Sam Jones is the new Flash Gordon.



Ornella Muti as evil Princess Aura.



callous Kala (Mariangela Melato).

Flash and company realize that they are no match for Ming and his minions and so, in order to raise the necessary forces of good, they desperately attempt to unite the two feuding princes of the Galaxy: Barin (Timothy Dalton), the leader of the tree-men, and Vultan the Hawk King (Brian Blessed), the high lord of the hawk people.

Details of Flash's out-of-this-world exploits are still very much top secret at the behest of producer DeLaurentiis and director Michael Hodges. The duo has been supervising the production since shooting began in England last August. For the past six months the ambitious space epic, designed by Danilo Donati, has been spread over six sound stages at Shepperton Studios, the entire *Star Wars* facility at EMI Studios Borehamwood, plus a titanic airplane hangar complex in Surrey which alone yields a six million foot capacity under a single supported roof.

With principal photography now drawing to a close, *Flash*'s crew is working on finishing its special effects for a December deadline. And that, according to photographic effects supervisor Frank Van Der Veer, is going to be one hell of a trick.

"In my estimation," he states, "*Flash Gordon* has more photographic effects work in it than any other movie ever made. Off-hand, I'd say that 75 percent of the movie features some sort of effect."

Van Der Veer, who won an Oscar in 1977 for DeLaurentiis' *King Kong*, elaborates further: "You see, in *Flash Gordon*, nothing really exists. You're filming on another planet in another universe. Your story takes place on Mongo and its many moons. The skies, the architecture, the terrain... *everything* has to be created from scratch. Even when you're shooting a scene in a normal building of one kind or another you're using effects because what's *outside* the windows of that building is completely unreal.

"And believe me, that's a monumental job to pull off. In effect, we're creating an entire environment. Right now, there are over 400 people on our payroll. There are three crews involved in photographic effects, which is more than usual for a film. The principal photography unit is very much involved with effects because most of it takes place on Mongo. That requires a lot of blue screen work. [A process which, eventually, will unite the live action "real" characters with the "unreal" world of Ming the Merciless.] The miniature unit will, of course, use a lot of blue

screen. Then we have a third unit that is concerned with blue screen work only."

The scope of *Flash*'s fantasy-filled spaceflight has presented Van Der Veer and his crew with a number of optical challenges. Clearly, the effects team must plot out every minute detail of the motion picture before the cameras film a scene, keeping their feet on the ground even when their characters do not. "We have a lot of flying in this movie," sighs Van Der Veer, "a lot! Now, in a movie like *Superman* it was very important to convince the audience that a man could fly. I think the people on that film did a marvelous job. What complicates our job a bit is the fact that we don't just have one man flying in a scene... we have 1,000 hawkmen. They are also flying in a very unusual setting.

"Whereas in *Superman* the Man of Steel was flying against a fairly realistic and familiar backdrop like New York City, our Hawkmen are flying against a setting of Mongo... a setting that is sheer fantasy. Every environment these characters enter is drastically different from the one preceding it. Nothing can be at all conventional. The skies have to be different, the land has to be different, the clothing has to be different, the architecture has to be different. Our job is to pull all this off realistically, so the whole film doesn't look like one gigantic effect. The best effects are the ones you don't really notice. They're the ones you accept and believe in."

Van Der Veer concedes that, in this film, the impossible is often required at a

(continued on page 69)

**Melody Anderson**  
plays the comely  
Dale Arden, who  
journeys to far-  
off Mongo with  
far-out  
Flash.

**Max Von Sydow** sports the mean Ming look.



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# The British Connection

Some of the finest science shows seen on American television aren't American-made.

By PAT GLOSSOP

**S**cience has never been considered a commercial subject for American network television. Although all three networks have, of late, attempted to introduce the scientific realm to prime time viewers, the subject is still generally regarded as nearly taboo on the tube. On public television, however, science has flourished, with specials and series appearing regularly throughout the country. In recent months, such PBS presentations as *Einstein's Universe*, *The Body in Question*, *Microbes and Men*, *Connections*, *Marie Curie* and *The Voyage of Charles Darwin* have drawn considerable public and critical acclaim. One of the most interesting aspects of these American PBS "hits" is that none of them originated in America. They are all British productions.

And the list of British imports does not end there. Going back a few years, one can add such shows as *The Ascent of Man* and *The Restless Earth* to the legion of British-made programs that have helped bring science to American television viewers in the last decade.

Why does so much of America's science journalism come from across the Atlantic? Has it drastically altered American programming? Does the import trend seem to be never-ending? These are just a few of the questions being asked in PBS viewing and programming circles at the moment.

Some of the answers are, of course, quite obvious. Britain's science programming has been dominant stateside because they do more of it than their U.S. counterparts. They've also been doing it longer. When public television saw the popularity of England's science shows with the masses across the Atlantic, they thought it quite natural to bring some of the more outstanding efforts to America. It's mainly on stations like WGBH in Boston and KCET in Los Angeles that science has found a video home. WGBH is responsible for the award-winning science series *Nova* and KCET is the headquarters of Carl Sagan's forthcoming *Cosmos* series.

*Nova* actually started as the offshoot of a BBC-2 science series *Horizon*; a long-running British documentary series which began in 1965. It is the longest running documentary



Above: Arthur Lowe as Pasteur in *Microbes and Men*. Right: Masai citizens in *Odyssey*.

television series anywhere in the world. *Nova*'s original producer, Michael Ambrosino, a veteran of public broadcasting, took his 40th year off and spent 12 months with the BBC. While there, he decided that America should have its own science series along the same lines as *Horizon*. Returning to the U.S. in 1971, he set to work developing the project and obtaining the necessary funding. In 1974, *Nova* was born.

"*Nova* was meant to be a model of many things," says Ambrosino, who was executive producer for the program's first three seasons. "It was meant to show American public broadcasting that we could do more than buy programs, that by creating a strand of our own in a complementary subject area we could choose the best of what the world had to offer and use it to begin a new series."

"By choosing the best, you immediately had an international standard to shoot at and you then had to produce your own programs to meet that high standard. Plus, you could put a sum total of shows on for a much lower cost. Consequently, we began *Nova* with the

idea of making 35 percent of our own programs, and in three years we raised that to 50 percent."

When the series first began, about half its programs came from the BBC, the majority of them from *Nova*'s mentor, *Horizon*, but the trend is now moving away from that somewhat. Of the first 20 programs this past season, for instance, 11 were made in-house at WGBH, six came from the BBC, and the other three came from Germany, Sweden, and a local Boston company called Peace River Films. To get the best of what's available worldwide, *Nova* has assigned one producer to concentrate on any and all foreign science films which may be adaptable to the *Nova* format. Globe-trotting to such affairs as the Paris Festival of Science Films obviously pays off. One of the most popular programs this season was "Life On A Silken Thread," an episode based on a German film which Sari Sapir re-constructed for *Nova*. The show concerned spiders, detailing everything you've always wanted to know but were too squeamish to ask.

While foreign-made films are often edited for stateside showing, most of the imported science series are shown in their original form, with the presenters occasionally adding extra sequences to fill out the U.S. time slot. WQED/Pittsburgh, for instance, produced discussion segments, hosted by E.G. Marshall, to be intercut with James Burke's *Connections*.

In the case of *Nova*, programs purchased from abroad are slightly altered for the American market. An American narration is added. And, occasionally, a program needs a healthy updating. Mick Rhodes, head of WGBH's Science Unit adds, "This usually isn't necessary, since we try to transmit the programs as soon as possible after their foreign air date." The biggest problem facing *Nova* with import shows lies in the fact that a BBC hour runs about 50 minutes while a PBS hour is approximately 57 minutes. New material must be added. The associate producer for *Nova* either shoots new material or adds extra footage that is sent with the episode.

One producer for *Nova* actually got the chance to adapt his own film. Robin Bates made "Living Machines," a film about the mechanics of biological creatures, for



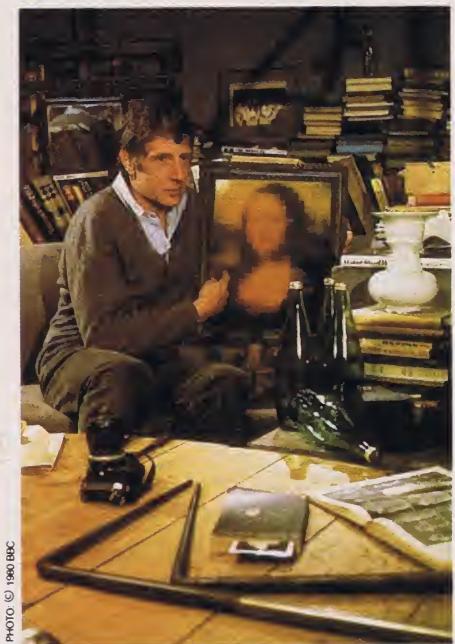


PHOTO © 1980 BBC



PHOTO © 1980 PBS



PHOTO © 1980 PBS

Left: The connection between a computer image of the Mona Lisa and the discovery of red blood cells is revealed by Jonathan Miller in the BBC series *The Body In Question*. Middle and right: Peter Ustinov journeys into the future and discovers his "twin's" grave in *Einstein's Universe*.

*Horizon*. He then became a producer for *Nova*, so when his episode showed up stateside, it was Bates who filmed the necessary additional footage.

Bates is just one of the *Nova* team who has worked for the BBC. Last fall, of the three male producers, all were English and two of them formerly worked for the BBC. The executive producer was male, English, and a former employee of the BBC; and one of the women producers was English and an ex-BBC staffer. That left three women producers who were American, two of whom learned about science filmmaking at *Nova*, starting at the bottom. (The bloodline with *Horizon*, incidentally, runs both ways. Some of the *Horizon* producers have worked at WGBH, and the two series sometimes co-produce a film, as in the case of *The Safety Factor*, which is about safety in the air.)

Until recently the BBC has been the main training ground for science documentary producers. Australia, Canada and Japan have produced some good films, but not in the quantity that the BBC can boast. The BBC trend, in fact, is industry-wide. The executive producer on Carl Sagan's *Cosmos*, Adrian Malone, who's also English, was producer-director on Jacob Bronowski's *The Ascent of Man* and the Galbraith series, *The Age of Uncertainty*, both BBC/Time-Life co-productions, and he'd previously made innumerable *Horizons* and other films for the BBC. Mick Jackson and David Kennard, who produced and directed James Burke's *Connections* (again, BBC/Time-Life), are also both veterans of *The Ascent of Man*.

"You don't pick up an aptitude for programming in science or any complex subject in a matter of days," explains Michael Ambrosino, who now heads an independent group called Public Broadcasting Associates. "Nor do you get shifted over from arts programs. If you're dealing with international politics, you must have several languages and

know the political processes of foreign nations. It's the same with science. You must know the foreign languages of several scientific subjects. You must be able to visualize the processes of science and know how to re-create them. Otherwise, science programming will be restricted to Moon shots, which are fascinating, and certain aspects of technology, but then you're only scratching the surface."

In making successful science television, it's not just the production team which counts—the choice of the right experts is always vital too. British viewers, lavishing praise on the 13-part BBC series, *The Body in Question*, agreed that it was writer/host Jonathan Miller who made it such a success. It was equally well thought of in the TV business: One BBC director says, "This is television at its best, how it should be, and it's largely due to Jonathan Miller, who really is a modern-day Renaissance Man."

Miller, who appeared in *Beyond the Fringe* in the West End and on Broadway, has directed films for TV, plays and opera. He's also qualified as a medical doctor, and has held a research fellowship in the history of medicine at London's University College. His talents all come together in *The Body in Question*, where he explores our attitudes towards the body, our ignorance about it and our inability to read its signals. For the series, he used an endless stream of imaginative techniques to educate his audience. He filmed red cars racing down country lanes to demonstrate red blood cells coursing through the veins; he used an excerpt from Mozart's opera *Cosi fan tutte* to prove a point; and he even breathed pure oxygen in one experiment so that worried viewers saw him black out on-camera.

While newer stateside science buffs will acknowledge Miller as a very charismatic host, other long-time viewers will remember yet another single talent which made a science

series: Jacob Bronowski in *The Ascent of Man*. "If you ask any taxi driver in London," said Adrian Malone after the professor's death, "he'll tell you who Bronowski is and that he's the only guy who ever made science exciting and understandable." You'd also get the same response from his American fans, who fondly remember that bespectacled figure standing in front of every conceivable monument, natural or otherwise, unravelling the mysteries of the universe for them.

American audiences are very aware of *Masterpiece Theatre* and the amount of British drama shown on PBS—though they often presume that British television automatically means BBC. The BBC's New York office, incidentally, has received so many calls congratulating the BBC on *Upstairs, Downstairs*, that it's stopped explaining that the series was made by Thames Television, one of Britain's independent groups, and simply accepts the kudos on behalf of Britain. But American audiences are probably less aware of the amount of British science documentaries that they see, particularly when they are adapted to fit the *Nova* slot. Not that *Nova* tries to mislead its viewers.

"We very clearly say if it's a co-production and where it came from," says Mick Rhodes, "and we run the original credits pretty much uninterrupted." Nevertheless, *Nova* producers report that people often congratulate them on various programs, taking no notice of whether they were made in-house or imported.

Even looking at the ratings, it's difficult to tell how Americans like the BBC inserts. According to PBS's Washington-based Communications Research Department, *Nova* as a series always rates very well, but the PBS polls don't differentiate between the BBC/WGBH co-productions and the in-house programs.

However, PBS admits that science is probably one of the most popular types of pro-

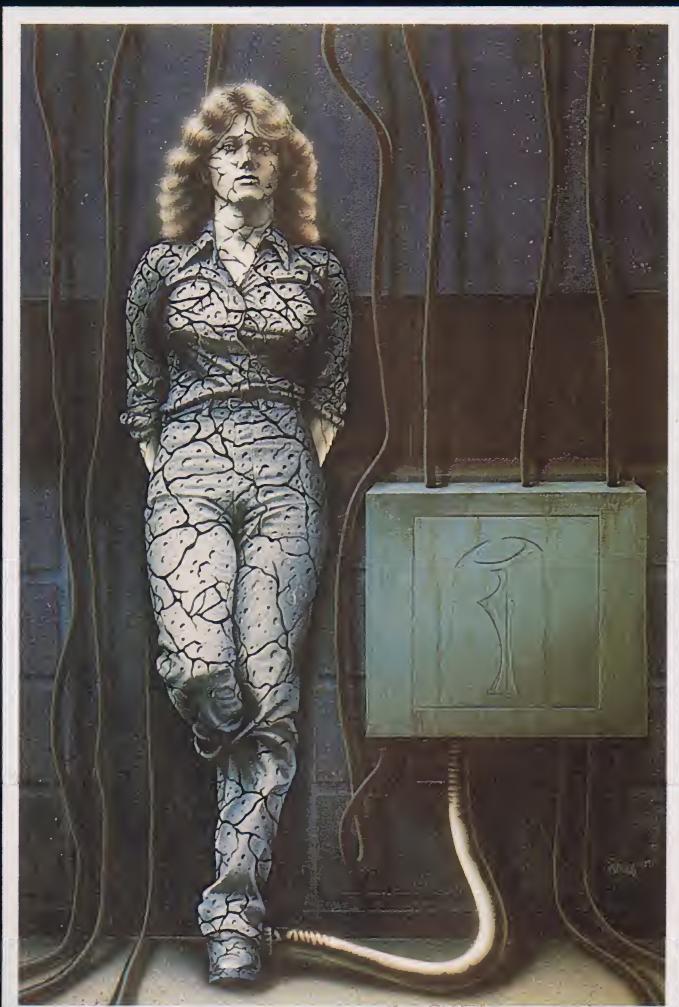
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# Barclay Show

**B**arclay Shaw is no stranger to these pages, having been a regular contributor to FUTURE LIFE since issue #8, when he created a spacefaring cybernetic musician to illustrate Ted White's Tomorrow column on Future Rock. Barclay's paintings and sculptures have also illustrated Tomorrow columns by Alvin Toffler (#12), Brian Aldiss (#13), Harry Harrison (#15) and Robert Sheckley (#16), as well as feature articles on videodiscs (#11), undersea farming (#14) and in this issue, "Trains of Tomorrow."

Although the 30-year-old artist's career as a professional illustrator was launched less than two years ago, his work has already made waves in science fiction waters. His first cover, for *Cinefantastique*, was followed by assignments for *The Magazine of Fantasy and Science Fiction*, *UnEarth*, *Galileo*, *Galaxy* and Berkley Books, and he contributed paintings to a Bantam book of extraterrestrial outlaws, *Wanted!*, to be published next fall. Many of his current paintings and sculptures are exhibited at Boston's Earthlight Gallery.

The artist displayed an appetite for exploration at an early age. From his official biography: "1955—After studying China in school, Barclay decided to pay a personal visit to the country by taking the most direct route, and departed by way of his backyard, armed with a shovel. Two and a half feet later, he decided the voyage required more effort than he had anticipated. Space travel



being the logical alternative, a rocket ship was fashioned from cardboard, a garbage can and a CO<sub>2</sub> fire extinguisher. This proved even less successful than the tunnel.

"1963—With his initial problems in rocketry resolved, Barclay built his most successful vehicle. The rocket was six feet tall in three stages, with a gyroscopic stabilizer, instrumentation to

record g-forces, an 8mm movie camera installed, and a three-inch by six-inch pressurized cabin in the nose cone. A large orange parachute was fabricated by his mother to insure a soft landing. Being of appropriate size, Barclay's pet mouse Sidney was volunteered to make the flight. Under the supervision of a film crew, liftoff and recovery went smoothly, the launch crew

recording the rocket's apogee at 1,200 feet."

He traces his lifelong interest in art back to a series of particularly vivid dreams he had at the age of 18. After studying sculpture and philosophy of religion in college, he sculpted full-time for eight months until he was forced to find employment as a wood-worker. He continued to develop his drawing and painting skills, and today he uses those skills to pay the bills—and enjoys it.

"I think the field of science fiction and fantasy is an unbounded arena for imaginative and visual concepts," Barclay says. The paintings shown here indicate his fondness for what he describes as "symbolic surrealism." On this page, "Regeneration of Maat" is an unsettling comment on human appetites for energy. The center-spread, "Iotian Phantasy," takes liberties with the latest scientific findings about Jupiter's volcanic moon, Io.

Barclay intends to continue his explorations of SF and fantasy themes. "The trouble with much of the contemporary art scene is that the symbolic or mythologic aspects of nature are discounted as not 'real' and therefore not worthy of expression," he comments. "In my opinion, technology—which these are an outgrowth of—is just as much myth for us as the pantheon was to the ancient Greeks. But each is just as 'real' in its effect on its society. Science fiction at its best reunites the human element with the myth of technology, filling that enormous gap."







Gil Gerard as Buck shows off the lean, mean look of the 25th Century.

Jean-Pierre Dorleac's opulently garbed villain Draco appeared in the pilot film.



Erin Gray as Wilma Deering models the functional, flexible jumpsuit.

Pamela Susan Shoop, a "Vegas In Space" jackpot.





Gerard in *Buck's "Vegas In Space"* episode with an alien gambler. The white jumpsuit is described as "working for" the futuristic wearer.



Jamie Lee Curtis displays the "synthetic" look in the "Unchained Women" episode. In the future, natural fibers are non-existent.

## 25th Century Style

Spandex and satin may not be the rage in Paris this year, but in *Buck Rogers*' 25th century, they spell high fashion.

By SAM BISBEE

**S**cience fiction has never been an easy subject to present on television. Mainstream TV series have their share of production woes in attempting to gather solid scripts, imaginative sets and agreeable guest stars week after week. But a science fiction show has additional problems unique to the genre to take into account. There are special effects to be created. Elaborate makeups to be constructed. And, in the case of NBC's *Buck Rogers*, 25th century fashions to be designed.

When producer Glen Larson unveiled his two-hour theatrical version of *Buck* a year ago, costume designer Jean-Pierre Dorleac managed to conjure up a century's worth of fashion in quick order: mixing contemporary styles with futuristic flair and a good deal of cleavage. Once NBC bought *Buck*, however, and it became clear that new fashions of the future would have to be designed for every single episode, week after week after week, Dorleac bowed out. The am-

bitious *Buck* was passed to designer Al Lehman. It promptly sent him into a state of future shock... and with good reason.

"Essentially we're doing a mini-movie a week, but I've been very lucky so far," he laughs. "I haven't experienced any major traumas as yet. The biggest drawback in doing a fanciful series like this is the constant pressure in regard to time. Before we can begin designing, we have to sit back while people worry about getting the sets ready and getting all the guest stars cast. Once that's taken care of, then it's up to us to worry about getting out-of-town actors in for costume fittings.

"We always have to worry about last minute story reshuffling that could knock out a couple of costumes or down-to-the-wire recasting. Somehow we still manage to get everything done for each episode. Sometimes we have to work on the weekends. Sometimes we work around the clock. There always seem to be new problems to

worry about in regard to our finished designs. One week, a character will change just before shooting is to begin. The next week, the plot. It's just a constant battle with time."

Episode after episode, Lehman and his crew must create new and exciting garments for both the series' regulars and the bevy of guest stars. It cannot be a hit or miss proposition, either. All the costumes must somehow be different from each other yet unified in theme or spirit. In order to accomplish this task, designer Lehman has had to concoct a futuristic philosophy that enables him to keep the costumes coming.

"I see the 25th century in an optimistic yet realistic way," he explains. "What I've tried to do is introduce plastics and things that look like synthetic fabrics into the show. When we get that far into the future, I feel that our natural resources will be used up. Although I wind up just using satin at times, I always attempt to get the fabrics of the future to look different than just everyday yardage. I like the sleek, metallic look."

"I also like to use a variety of colors in the costuming, both as a design element and as a reflection of the character's personality. Many of the villains are garbed in darker colors while some of the livelier guest stars get more dazzling hues. There are some people who believe that, in the future, all color will be gone from society. Humanity will live in a regimented, dull society. One world. One rule. People without emotion. That kind of civilization would restrict us to natural colors. Since I don't personally believe in that scenario, I have the liberty of using a lot of colors and having a lot of variety in our future wardrobe."

Barry Downing, star Gil Gerard's dresser, sees Lehman and Dorleac's designs as being spacey yet down-to-Earth. "The clothes of the future are sleek," he states. "They work for you. We use a lot of reverse spandex which we dye different colors for use in Gil's jumpsuits and for the clothes used in the different martial arts sequences of the show. It changes shape with the body movement. The 25th century line of fashion is basic yet tasteful. They have to be part of the character."

"For instance, with Gil we try to make the outfits secondary to him. During the course of the show, Buck changes outfits quite a bit. Yet the viewer really shouldn't notice the outfits as much as they notice Buck. That's a challenge for a designer."

"People will come to the costume department and say that they want something new, they want something different, they want something that's never been seen before. If a writer says that there are no zippers in the 25th century and that clothes have a better way of fastening, some of the guys really expect you to *invent* something. On a show like this, we not only have to dress our actors and come up with costumes for the 25th century but convince everyone else concerned that our designs are right because *everyone* has their own ideas about what the future will look like."

"Every week, we have to start from scratch using each individual script as a starting

point. We have to see what the script's needs are. For instance, if a script calls for a sleek outfit to tear during the course of the story, we know immediately that we can't use spandex because that won't tear. So we then have to come up with a suitable replacement fabric. Once we find out what the clothes have to do, we then work under deadline to come up with costumes that look as new and original as possible. We often have to use previous styles that have worked in other episodes."

"In a vampire story we shot recently, we had Buck dressed in light colors to offset the dark, brooding show. His suit was a combination of previous jumpsuit designs, yet was modified enough for it to look like an original for the episode. We added a wide belt that accommodates four-by-eight-inch batteries needed for his torch light, pockets that allowed him to carry large objects, etc. The outfit had to be functional but yet look sleek enough to make it standard *Buck Rogers*."

Lehman is very much aware of the fantastic demands made on him and his staff by

the head villain to the lowly henchman. Once that's done, it's on to another line for the next week."

Despite the wide variety of costuming called for, Lehman does have certain foundations of future fashion sense from which to build. "I think that the form-fitted look will be popular in the future. We dress girls in boots, either high or low, with short skirts, short pants or tight fitted pants. There's no excess fabric hanging around to catch on things like you have on so many of today's fashions. The men also adhere to a sleek look. We eliminate anything that restricts the actions of the wearers. We're working with villains and villainesses who are very active. There's always a lot of zapping, running and falling going on."

"So the storylines themselves dictate and often restrict what we do. Now, when I have someone like Princess Ardala on the show, I can relax a bit. She's a villainess who is very exotic and just stands around and looks beautiful. I can put exotic fabrics and flowing capes on her and use delicate ornamentation. It will work for her as opposed to some of our more dastardly, active types."

"I've also found myself using the quilted look which has become so popular this past year. I figure that, in space, people will use this heavy quilting for insulation and protection. I use this for designing space outfits as opposed to the look that's used for leisure and everyday wear. What I'm trying to do is make everything as different from the norm as possible."

Lehman is admittedly often frustrated in his attempts. "I'd love for someone to invent a fabric that is clear as glass and soft as fabric," he sighs. "But that hasn't happened yet. Occasionally, I try to use clear vinyl for outfits but the material is stiff and doesn't really 'breathe.' I haven't been very successful so far. I've gotten to use it in a few designs: around the midriff or on sleeves. The actors don't seem to mind our experimenting. In fact, they encourage it."

Downing readily agrees with designer Lehman, adding, "The cast loves wearing the futuristic costumes. In fact, most of them want to take the garments home with them when they're finished shooting. We did a segment with Gary Coleman and he was just so enthused with the outfit that Gil Gerard made sure that Gary got to keep his costume. He's been wearing it throughout the rehearsals on his *Diff'rent Strokes* show."

Despite the hectic time schedule, the bizarre plot requirements ("Ever try to design a costume for a futuristic vampire who isn't even supposed to exist?" asks Lehman) and the general grind generated by weekly TV series work, it is clear that Al Lehman and his spacey costume crew enjoy their task. "The best thing that any viewer could say about my work," he says in summation, "is that in our future, there is a variety of styles and that our costumes fit the characters' personalities."

The next best thing a viewer could note is that most of Buck's female guest stars this season have been bursting at the seams with personality plus. Clearly, in the 25th century, a winning smile and a swath of spandex make for fitting futuristic fashions.



Gary Coleman dressed in designer Al Lehman's mini-regal jumpsuit in the popular "Cosmic Whiz" episode of *Buck*.

the ever changing science fiction scenery. Making matters more complicated for the wardrobe maven is the fact that he was not the show's original guiding light. "Stepping into *Buck Rogers* wasn't easy. We had the original film's costuming by Jean-Pierre established. Things like the flight uniforms which have to be included in the show in almost every episode. I'm just now adapting them slightly to suite my tastes. Every designer does that. You like to make the show your own look and then take total responsibility.

"With *Buck*, you're really designing for two separate sets of characters. Our leading characters are in their regular clothes almost every show unless the plot calls for something very special. They have a very succinct, straight look. Every episode introduces new characters, however: new girls, new villains, new guards. We can't repeat ourselves, design-wise, in that area. Every chapter of *Buck* is almost independent and we must design accordingly. What I try to do is set up a look that will serve for a whole line of characters from

## Spaceburgers

From time to time I receive letters from vegetarians who demand to know whether I condone eating, as one lady put it, "potential human beings" such as cows and bunny rabbits. So I'm going to make a public confession: Not only do I condone eating meat, I practice the deed myself. In fact, I run a small home-scale farm, and in addition to the standard organic vegetables and fruits I raise poultry, goats and rabbits, which I personally butcher and eat.

But when we move to outer space, won't we leave all that behind? Veggie literature would have us believe that every pound of meat on the table takes four or five pounds of beans out of the mouth of some starving Hindu. In space, veggies reason, folks will have hardly any farmland, so they'll be forced to eat the most efficient (translate: vegetarian) diet.

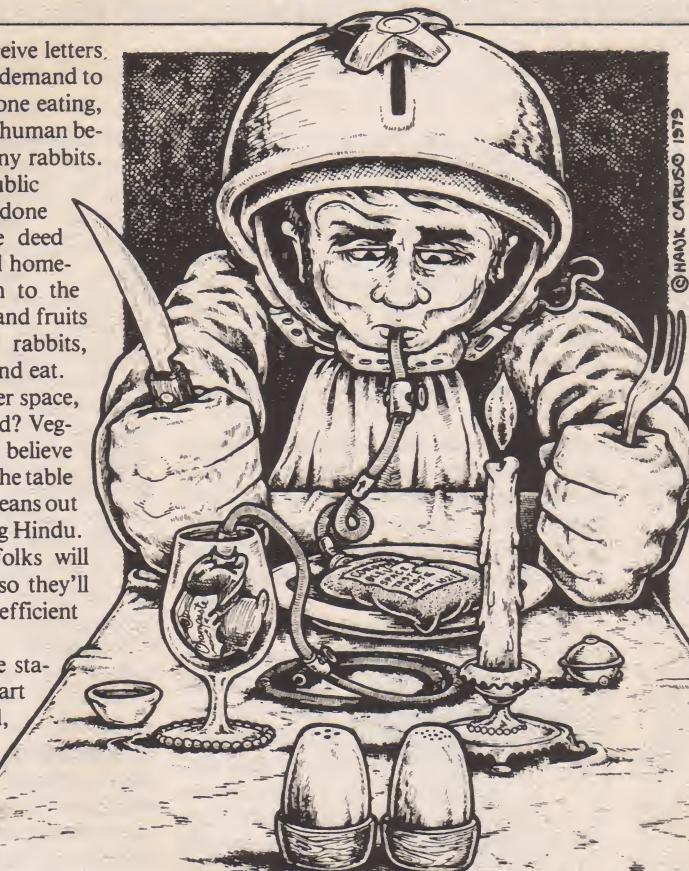
In the early days of space stations this will be true—the part about hardly any farmland, that is. (Later, as we tap the resources of the solar system, we'll be able to build tens of thousands of times as much farmland as we have on Earth today.) But does a vegetarian diet make the most efficient use of farmland?

Last summer a group of NASA-sponsored space farm experts held a seminar to compare notes on their research on how to maximize food production. Not surprisingly, nearly all of them had assumed the farm should grow a purely vegetarian fare. But not researcher John Phillips. His agricultural system would treat space dwellers to hamburgers and milkshakes, in addition to providing as much grain, beans, vegetables and fruits as the other researchers' systems, *all on the same amount of land*.

Disbelieving, the other researchers questioned him, "Where's the animal feed coming from?"

Replied John, "You've got all these cucumber vines, corn stalks, broccoli leaves and so forth you've got to recycle. How about recycling them through a cow or rabbit? Here's a picture of a rabbit I raised on nothing but cucumber vines. And we have to clean off the dinner plates. Mind if I recycle the kitchen garbage through some chickens?"

NASA research into feeding space settlers has come a long way. Back in the early days, just after Sputnik, even NASA thought space was awfully weird. So, obviously, space settlers would have to sustain their vital functions in a weird way. Some researchers proposed performing surgery on space cadets to



replace their digestive tracts with little atomic power plants, eliminating both the need for food and toilets that work in zero-g in one stroke of the engineering imagination. But the side effects appeared formidable, and no one volunteered to be a guinea pig.

More moderate researchers proposed that space dwellers should eat synthetic food pills. They spent millions inventing processes to brew up formaldehydes and ketones and similar goodies from pure hydrogen, oxygen and carbon, but no one could figure out how to eat that stuff without being simultaneously killed and embalmed.

But NASA was learning. They discovered the importance of finding a means of nourishment that didn't kill its consumers. At the same time they wanted to grow something that could recycle human wastes. So they tried sludge. The stuff that grows in sewage ponds. The researchers picked out two food candidates: chlorella algae and hydrogen fixing bacteria.

Voila! The volunteers who ate the sludge

*Carolyn Henson's byline was regrettably omitted from her column last issue. The writer is a co-founder and former president of the L-5 Society, the grassroots organization dedicated to the large scale industrialization and human settlement of space in our lifetimes.*

didn't die! They barfed and had the runs and wished they could die, but they didn't.

In May 1975 my husband Keith and I got a desperate call from space structures researcher Jerry Driggers. He had heard we were independently studying the space farm problem. His problem: The researcher who had planned to give the talk on growing food in space at the Princeton Space Manufacturing Conference had cancelled. We agreed to fill in.

"Promise me one thing," asked Jerry. "Don't propose that we eat algae. I've tried those NASA algae cakes. They're awful."

We got a real kick out of showing the NASA folks at Princeton that a farm that makes real food—hamburgers (actually, we proposed rabbitburgers), french fries and milkshakes—would cost less and take less area than a sludge farm. That the food was fun to eat and didn't make people barf was a fringe benefit.

But we hadn't yet nailed shut the sludge-eaters's coffin. Two years later

Keith and some agriculturalist friends

went to NASA/ Ames Research center for what turned out to be the final showdown. To their surprise, the sludge-eaters were out in force. Those folks had even found a kind of bluegreen algae that people could eat without vomiting—an algae that grows only in exotic carbonate lakes, and slowly at that. But as the province of space provender had moved from the domain of nuclear engineers to chemists to microbiologists, it seemed fated at last to finally move into the hands of farmers.

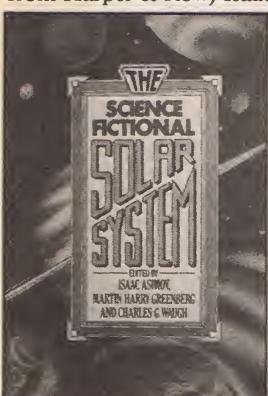
Toward the end of that space food study NASA brass paid them a visit. They were there to make the Big Decision: Should the government's space colonists eat sludge, or food? They had plenty of questions. Won't all the farm plants and animals catch a weird space bug and die?... What happens if a weed gets in the lettuce patch—it'll be all over!... What if the cows overpopulate and eat up all the corn?... The list of NASA's farm paranoias was endless.

For a while it looked as if the sludge might win simply because the brass felt more comfortable working with stuff that grows in wastewater reclamation ponds. But then a young agricultural researcher discovered the key to their minds. A few topless dancers, plenty of good food, booze and loud music, applied nightly, did the trick. He convinced them: NASA's space settlers will be permitted to eat real food!

## Futant Reading: Other Planets and Realities

### Science Marches On

One of the problems with writing science fiction is that sooner or later the future catches up with you. In *The Science Fictional Solar System* (\$11.95 in hardcover from Harper & Row) Isaac Asimov, Martin



Harry Greenberg and Charles Waugh have organized a tour of the solar system that shows us how the future's gained on some of SF's best.

The book's 12 sections—one each for our solar system's sun, nine planets, the asteroid belt and the wandering comets, all appearing in orbital order—are each introduced by an Asimov essay that explains what we understood about the body in question when the story that follows was written. The essay also explains how space probes, radio astronomy or science's latest theories have kicked holes in the author's ideas about said heavenly body.

The collection's stories appeared from the '50s through the '70s and all 13 of them (Pluto gets two for some reason) were accurate according to the data then available, but science has marched on. The slips range from small ones like Arthur C. Clarke's in "Saturn Rising" where he posits a lovely hotel overlooking Saturn's rings and has Janus (a recently discovered moon) missing from his scenery, to victims of more drastic changes like Robert Sheckley's delicious "Prospector's Special." Sheckley's prospector wanders across a super-Sahara Venus—the 1959 model of the planet. Sadly, the Venus our probes have described (500° C. at the surface) would have toasted the young man long before the end of the story. Or take Poul Anderson's "Barnacle Bull," a story written in the days when some astronomers thought the asteroids were the remains of a shattered planet, leading Anderson to devise some fantastic interplanetary fauna. Again, present-day guesses are much more mundane—the asteroids are believed to be a potential planet that just never got it together.

These stories range from fun to fascinating and, as Asimov points out, there's so much still to learn out there that some of these tales might turn out to be right in defiance of today's expert opinions. The collection includes James Blish, Terry Carr, Larry Niven and a

half dozen of SF's other literary lions, and their tour of the solar system is worth taking.

### Explosive Thriller

Lovers of category call fiction that extrapolates a possible future and tries to stay scientifically accurate "hardcore" SF. Nicolas Freeling extrapolates a frighteningly possible very near future in his hardcore science thriller *Gadget* (\$1.95 in paperback from Penguin).

*Gadget* is physicists' jargon for an atomic device. Jim Hawkins, a young American physicist working in Germany, knows what a gadget is even though he's never worked on one. So do the terrorists who kidnap him and his family. The terrorists want Hawkins to build a gadget for them.



This isn't a story about gun-waving masked fanatics. Jim and his wife are fabulously fed, kept on a lovely country estate and given everything they want—except their freedom and their children. Fear starts Jim on the task, but he becomes fascinated by the process and the pretty numbers keep him going. This is the story of a scientist seduced by the ultimate technological challenge and a woman tormented by the cost in human lives if her husband succeeds.

Author Freeling skillfully assembles this blueprint for disaster before your disbelieving eyes. His science is right and his characters chillingly realistic. In the end, watching these two people change from ordinary to obsessed is fully as frightening as watching how simply the bomb comes together.

*Gadget* is a stark, scary novel that accurately portrays the terrifying possibilities of nuclear terrorism. It simply will not let you go until the final explosive page.

### Unreal Spectacular

Robert Anton Wilson wrote *Schrodinger's Cat* (\$2.50 in paperback from Pocket) which concerns a character named Joe Malik. Joe is writing a book about a character named Robert Anton Wilson. Robert is writing a book entitled *Schrodinger's Cat*. And that's only step one in the confusion of this comedy

about quantum physics.

Step two is the discovery that *Schrodinger's Cat* (the book Pocket published) is made up of three sections: "Schrodinger's Cat," "The Universe Next Door" and "The Trick Top Hat." Each of the three sections have characters in common (except that they sometimes change their names or sexes or occupations) and tell, sort of, the same story (but not in the same order).

The only people here who seem as confused as you are the two editors who pass memos back and forth in front of you. These might be some sort of key except that they don't even know when to laugh.

Step three in the confusion is the realization that Wilson is a very dangerous character. He's playing games that may alter your programming.

Step four is when you discover that it's fun to have your programming altered.

Now *Schrodinger's Cat* (which is, somehow, where all this started) is a paradox of quantum physics. It posits a cat in a box with something that will kill it (such as a gun or a bomb) and this lethal device is triggered by some quantum process at an indeterminate time. Now, a physicist should be able to tell whether or not the cat is dead by sitting down and working out a series of quantum equations. The trouble comes when you realize that the equations yield a *minimum* of two values: one will say the cat is dead and the other will say it's alive. Most physicists would naturally rather ignore the paradox because quantum physics works—it makes events predictable.



In these pages Wilson is sneakily asserting, along with a few rogue physicists, that these events are predictable because the physicists want them to be—that consciousness is in control. He also agrees with the other rogue physicists who think that both sides of the paradox are true—the cat's alive in one universe and dead in another. Some people say these guys read too much science fiction. Wilson might agree with them, too—in another universe.

*Schrodinger's Cat* offers impossible possibilities, with paradoxes rampant. It encourages the worst sort of social levity and

should definitely be on every futant's bookshelf just for fun.

### Star Phobia

John Macvey has distilled the most profound pop paranoia of your favorite ufologists in *Space Weapons, Space War* (\$9.95 in hardcover from Stein and Day), a book that purports to explain "how we and alien beings will fight the wars of the distant future." Suddenly, all the hardware dreamed up by SF writers is supposed to be just over the horizon . . . and we may have just enough time to circle the wagons.



Macvey spells out his premise in simple how-to handbook style complete with his own amateur sketches. You see, they are going to find us because we were silly enough to use radio and television after we discovered them. They will get rid of us by flooding the planet (as per Genesis), using heat rays (a la *War of the Worlds*) or with a multitude of gaily colored rays (as in the rest of the pulpish invader-from-beyond epics).

Sure, a lot of Mr. Macvey's science seems accurate enough, but when he puts it in the middle of one of his cautionary lectures about UFOs over South Carolina it looks odd to say the least. Really, there's nothing here that hasn't already been covered in Asimov's *Choice of Catastrophes* or the recent future war study, *War in 2080*. So I can only join the author in his exhortation: Readers, watch the sky! If you do, you might manage to miss this book.

### An Alien Space

Science fiction is mostly an American enterprise. Its first boom was in the American pulps, its biggest market is still here, and most of its prime practitioners call the U.S. home. But there have been a number of notable exceptions to this rule and Poland's Stanislaw Lem must be numbered among them. Mr. Lem has

written more than two dozen SF titles in his native tongue and translators have been dol-



written more than two dozen SF titles in his native tongue and translators have been dol-

ing them out to us just about as quickly as they can decode his antic linguistic perambulations. The translators' latest gift to American readers is *Tales of Pirx the Pilot* (\$7.95 in hardcover from Harcourt Brace Jovanovich).

The volume contains a series of stories Lem wrote in the late 1960s about Cadet Pirx, a rather simple young man who stumbles in and out of trouble faster than a speeding tachyon: In "The Test" we observe young Pirx on his first solo space flight—an episode that has his ship disabled by a pair of amorous flies, treating Pirx to an epic flight from Earth to Moon. It's a funny bit of scientific slapstick with a suitably twisted ending.

"The Conditioned Reflex" and "On Patrol" are stories in the same vein—Cadet/Pilot Pirx versus Murphy's Law (the law which states that anything that can go wrong will), with Pirx prevailing in the face of bizarrely misbehaving machines. For a writer who longhair critics claim has "elevated science fiction to literature," Mr. Lem seems a bit off the mark.

The book's final story, though, almost rescues the collection as it measures up to the standards set by Lem's best novels (*Solaris* and *Memoirs Found in a Bathtub*). "Terminus" is a simple scary story that shows how our machines sometimes bear the brunt of our disasters. Terminus, a tiny robot, is the only survivor of a shipwreck in space and Pirx discovers that the robot is constantly reliving the accident and the death of the crew. Pirx's realization is beautifully handled and his decision suitably tortured, but this isn't enough to rescue this flawed collection. You might watch for "Terminus" in next year's collections, because Lem's combination of a ramshackle gothic future and a haunted robot deserves better neighbors.

### International Eclectic

*Rooms of Paradise* (\$8.95 in hardcover from St. Martin's Press) is an international collection of the best that SF can offer, edited by Australian author Lee Harding.

**ROOMS OF PARADISE**  
New Stories for Tomorrow by Brian Aldiss, Michael Bishop, Gene Wolfe, R.A. Lafferty, Cherry Wilder, Ian Watson, Sakiyo Komatsu, George Turner, & others  
Edited by Lee Harding, Foreword by Roger Zelazny



Harding has managed to come up with an international crew of newcomers who make this collection a book you shouldn't miss.

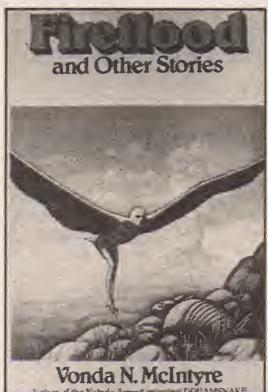
Harding commissioned the writers to

imagine the future of the individual and they've given us an even dozen good stories about love, death, dreaming and magic. Each of the stories has something fresh and new about it—a refreshing sense of possibility.

Aldiss offers "Indifference," in which a priest meets his god on a new world and in a strangely shattering confrontation realizes that neither of them really cares. David Lake and Philippa C. Maddern offer two entirely new ideas about time travel in "Redeem the Time" and "Ignorant of Magic" respectively, while Sakyo Komatsu's story "The Savage Mouth" gives you a twisted look at the ultimate in personal alienation and self-destructiveness. Plus, Michael Bishop explains the problems of having someone move into your body with you in "Collaborating." And there are seven more excellent stories set up by Roger Zelazny's thoughtful foreword. *Rooms of Paradise* opens an international array of doors for the American audience, so watch for these aliens among us. It can only do you good.

### Prequels in Sequence

Vonda McIntyre's first story collection is something to cheer about too. *Fireblood and Other Stories* (\$10.95 in hardcover from Houghton Mifflin) displays the hypnotic style, exotic settings and sheer craftsmanship that have made this young writer an award winner.



McIntyre makes shrewd use of her background in genetics and biology. Her stories explore the possibility that her characters' bodies may change as much as the world around them and she has thoughtfully considered the human costs of these changes.

The title story "Fireblood" finds tomorrow's astronauts victims of a new budget cut and asks the question, what do you do when you've altered your people as much as you've trained them? Have they just lost a job, or given up any chance for an ordinary life now that they're something other than human?

One of the collection's high points is the Nebula award-winning "Of Mist, Grass and Sand," the story of Snake the Healer. This compelling short so fascinated the author that she found she really couldn't work on anything else until she had resolved Snake's story. The resolution was last year's Nebula and Hugo award-winning novel, *Dreamsnake*. If you haven't read either effort, this alone is worth the price of the book.

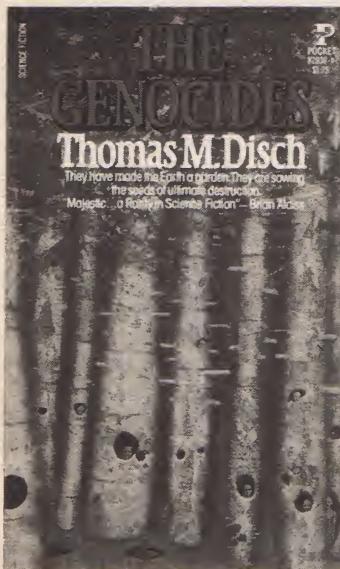
But there is much more to this collection than one award winner. "Wings," "The Mountains of Sunset, The Mountains of Dawn" and "The End's Beginning" are three stories following a race of winged humanoids (who may once have been human) as they start out toward the stars. "Only

"at Night" is a tale strange enough to make you sleep with the lights on, and "Recourse, Inc." is a delightful little discourse on the proper revenge against one of those credit company computers.

The remaining four stories are "Spectra," "Screwtop," "The Genius Freaks" and

"Aztecs," a story nominated for both the Hugo and Nebula awards. Like the rest of the collection, these tomes are meant to be savored. These are strong statements about the cost of change, the difficulties of being different—emotionally charged and beautifully executed.

## Books in Brief



**The Genocides** by Thomas M. Disch (\$1.75 in paperback from Pocket Books). Most science fiction stories dealing with the extinction of the human race accomplish this grisly task using either atomic holocaust, biological or chemical warfare, or annihilation by unfriendly aliens. The aliens in Thomas Disch's 1965 novel are not only distinctly unfriendly, they are totally unconcerned with the existence or nonexistence of Earth's native species; their only interest is in using the planet as a farm for huge, deeply rooted plants. However, the "farmers" have to protect their crop by ridding the Earth of any pests that may damage the crop; i.e. its human population.

Specifically, the storyline centers on a small settlement of men and women who find it increasingly difficult to exist on any kind of organized and civilized level. Not only must they cope with the havoc the huge growths are causing Earth's fragile ecology, but they must also deal with the mechanized sentries that methodically set fire to any human habitation. And as food gets scarce and the few survivors are forced to hide within the roots of the plants themselves, the totality of their defeat begins to prey on their minds.

*The Genocides* is by no means a cheerful book to read; but the skill with which it is

written and the fascination of the story itself makes it well worth your while.

(Barbara Krasnow)

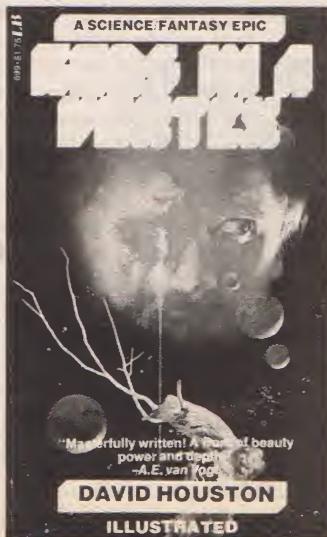
**Gods in A Vortex** by David Houston (\$1.75 in paperback by Leisure Books).

This is a strange story, strangely and masterfully written. The opening scenes are episodic; but the story grows rapidly and impressively. The characters have names like Luke Skywalker in *Star Wars* (examples: Isle Firemaker and Sky Tinsmith) which, considering who the author is, suggests that this novel may be headed for a movie sale.

But the comparison, though there are other parallels, essentially ends there. In *Vortex* the characters become people in a very rich meaning. I was startled by the behavior of the female lead, but not alienated. Particularly worthwhile is the skilful way that the background detail grows upon the reader. The author seems to have data in such limitless quantity, and quality, that, after a while he is sprinkling it into virtually every sentence.

This is David Houston's second science-fiction novel. It is a work of beauty, and power, and depth. And the question arises: what is he doing in a genre field when he should be out there striding the stellar reaches of mainstream literature?

(A.E. Van Vogt)



**Jailbird** by Kurt Vonnegut (\$9.95 in hardcover from Delacorte Press). When Kurt Vonnegut was a very young man during World War II, he witnessed the bombing of Dresden by the Allies. As a prisoner of war held captive in that ornate city, he watched several days of explosive activity obliterate several centuries of art and history. Today, Vonnegut is a mastercraftsman of literature; a producer of novels wherein nothing is all that sacred and nothing lasts for a week, let alone forever. Vonnegut's realm is constructed like an intellectual Rube Goldberg cartoon. Even the most innocent act triggers an ironic ramification. Sometimes it might take a week. Sometimes a month. Sometimes a decade. Whatever. It all catches up.

*Jailbird* is not so much an intricately structured novel as a monologue by Vonnegut or, more specifically, main character Walter F. Starbuck. Starbuck is a nice man. A good man. But a boob. During the Watergate scandal it is Starbuck who winds up paying the highest price, totally disgraced although innocent through sheer ignorance. Thrown in jail alongside noted science fiction writer and philosopher Kilgore Trout, Starbuck works towards his release, achieves it and then attempts to rebuild his shattered life. Fate intervenes in the form of a mysterious bag lady. Soon, Walter is controlling the world's most powerful conglomerate, RAMJAC. His rise to power is swift. So is his fall. En route, however, Starbuck begins to take note of himself, his world and whatever may lie beyond.

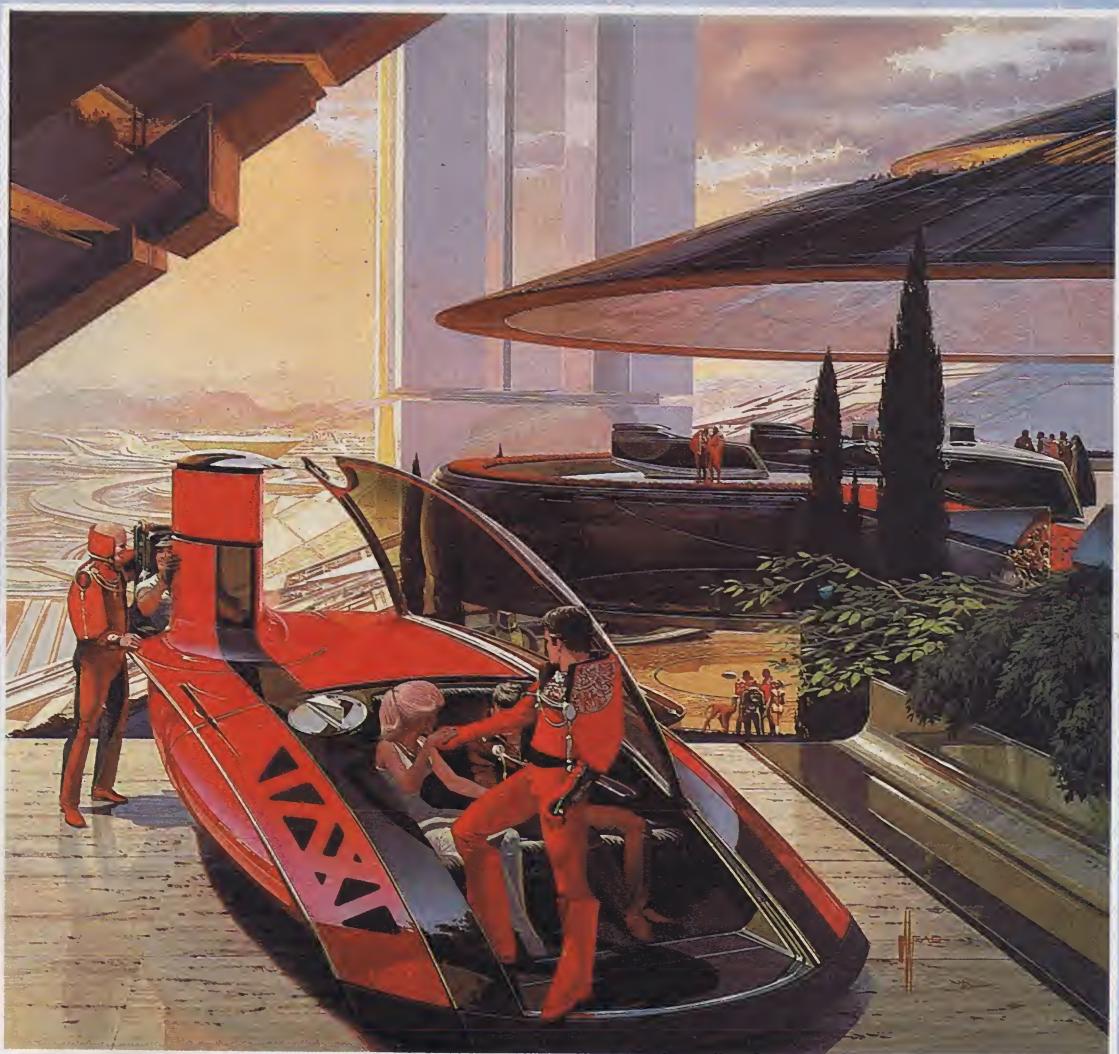
In Starbuck's world, nothing is ever totally certain, good and evil are never clearly delineated. Even Walter is not sure about who he is or where he is going. As one character remarks. "You couldn't help it that you were born without a heart. At least you tried to believe what the people with hearts believe—so you were a good man just the same."

*Jailbird* is expertly crafted in Vonnegut's beguiling, simplistic prose. It's a book that is alternately funny and frustrating. Yet, even at its most improbable points, it makes total sense. In terms of style and substance, the book always soars.

(Ed Naha) 

# Steel Couture

## Syd Mead Shapes the Future



Arriving guests alight from an aircab overlooking the "Norcon Center" surface transport interchange. Private gondolas glide around two arrival decks on the translobby levels. Leased

condominiums at upper left house both private and corporate groups, while the Mega-rise in the middle ground holds scores of national and international offices.

**S**y Mead is a visualizer of the American Dream. He takes the year 2000 A.D. as his time and space reference, designing the cluster-pod housing, computer-guided automobiles, walking trucks, three-dimensional laseramas, space stations and outrageous space-colonial alien contact suits which will be ubiquitous in the ultra-modern world. His design strategy is the only one possible for a futurist; he shapes the future in order to predict it.

Syd Mead's work is in part synonymous with an energy-intensive mechanized society and in part a celebration of the skills and presentation techniques of the industrial designer. His polished machine-images are perfectly styled and immediately gratifying. The force of his work lies mainly in the technical

feasibility and historical possibility of every object, vehicle and building he proposes.

The powers of invention, which Syd Mead displayed right from his college days, have led to a highly successful and productive career. Over the past 20 years he has been a design consultant to the future. His services have been in demand by many industrial giants, including the Ford Motor Company, Philips, Chrysler, United States Steel, Alcoa and Celanese. He has styled space vehicles for NASA, and the ships, trains, trucks and cars of today were on his drawing board in 1965.

*Sentinel* (his handsome oversized book containing more than 100 paintings and drawings, just published by Dragon's Dream) is not a book of fantasy. It is a visual encyclopedia of the possible. As a highly trained industrial designer, Syd Mead makes sure that all his blueprints are working drawings. This technical conviction and brilliant finish give steel, glass and chrome a sense of

purpose and reality in all his images—from inner-city transportation systems to mega-structures in outer space.

Above all, Syd Mead is not a designer who can be categorized. He is perfectly relaxed when working on a contemporary product or architectural illustration because he reserves the right to present any idea to its best advantage—as he sees it. On the other hand, when given the opportunity to develop new concepts in any product line, his imagination soars through current consumer usages and sociological analyses to such elegantly arranged solutions that one wonders why his design for a product does not instantly become the new standard.

Syd Mead's design approaches to any subject are always realistic, yet are amplified by a rich imagination which raises them to the level of fantasy. But his technological expertise and drafting skills make these fantasies not only realistic—but realizable.

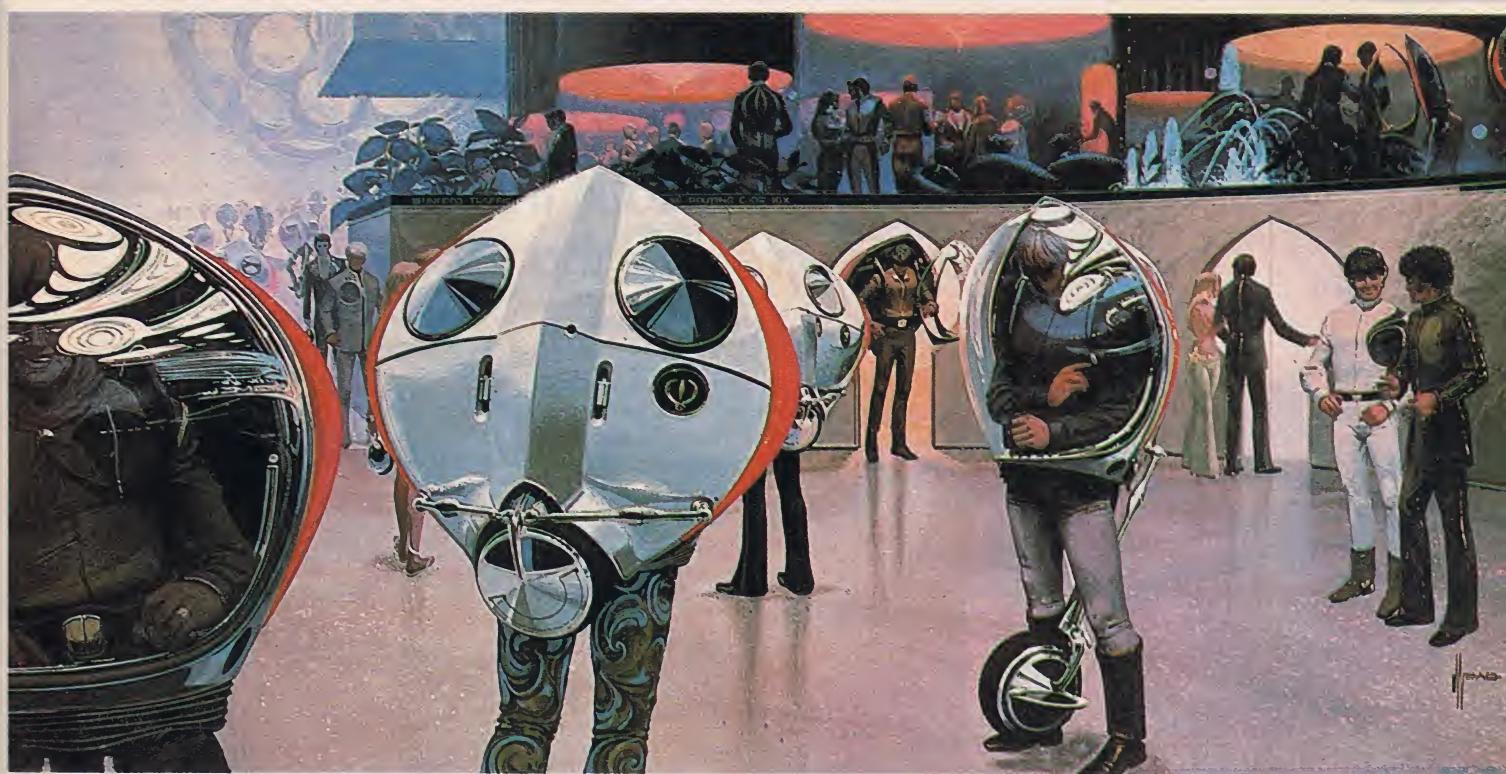


Here a gyroscopically balanced, single-wheeled racer has just entered a pit/service area. The bulge in the middle of the hull encloses one huge tire and a traction motor. The driver, wearing a Mylar reflective flame suit, is just getting out. He normally drives

the machine from a prone position supported by a couch similar to that used in a space capsule. This design was intended primarily to emphasize the specialized role that steels play in high-intensity equipment.



Showroom scene, anti-gravity coupes: This scene is from the U.S. Steel book, *Concepts*. The anti-gravity coupes are just floating and humming softly, while the salesman on the left interests an elegant woman in the qualities of 21st century transportation. The man with his son in the upper right is probably making a traditional deal.



Unipod Gyroscopically Balanced Personal Vehicle was conceived for an article in *Automobile Quarterly*. Mead describes it as "a carapace with a pair of mercury gyros on the back that would serve as a personal mobility device in the future megastructure

environments and multi-level commercial areas. In practice, the 'wearer' leans back into the shell, the strut extends and the wheel folds out while the small pancake motor in the hub provides propulsion."



Anti-gravity passenger vehicle, and tractor with ultra-sonic Earth aerator: Again from Concepts—a couple with a light, personal anti-gravity flyer have stopped to talk with their neighbor while he is taking a break from cultivating his field with an agricultural crawler tractor. The psychology of the scene: To bring a human touch to the massive steel machinery by including the gentle social qualities of rural life. Future tech-

nology has, however, improved the functions of farming through the use of ultrasonic generators on the rear of the tractor (in place of a plow) that disturb and aerate the earth beneath the surface without breaking the soil. Visible in the background is a farmhouse complex and a power antenna receiver with which energy is collected and then distributed throughout the system.

# The 1980s! A Backward Glance

## A new book fondly recalls the 1980s— a decade even screwier than the '70s.

By ED NAHA

**I**magine a decade wherein meat-legging becomes a major crime.

The list of best-selling books includes *Dead!* by Piers Paul Read (the gripping story of a group of passengers who fail to survive the crash of a DC-10 jetliner in the Canadian Rockies) and *Hitler Said the Darndest Things* by John Toland.

Organized crime orders the mass execution of 13,000 fish in a sedan; thus wiping out an entire species of marine life.

Nuclear power plants are refurbished and turned into apartment complexes.

And 1984 becomes a hit musical comedy film starring Leif Garrett and Tracy Austin, with Marlon Brando as "Big Brother" (music and lyrics by The Bee Gees).

Sound strange? Absurd? Incredibly realistic? The decade in question is all of that and more, the "star" of a recently published book entitled *The '80s: A Look Back at the Tumultuous Decade 1980-1989* (\$14.95 in hardcover, \$6.95 in paperback from Workman Press). Edited by Tony Hendra, Christopher Cerf and Peter Elbling, the book is a futuristic overview of a decade that is, if possible, even more absurd than the recently deceased 1970s. As envisioned by Hendra, Cerf and Elbling, the '80s is a ten-year stretch of time fraught with bizarre fads, even more bizarre political doings and outright lunacy.

Why pick on the 1980s? "Well, they can't fight back, can they," smiles Tony Hendra. Hendra, one of the founding fathers of the original *National Lampoon* and the epic newsprint satire *Not The New York Times*, cheerfully explains the rather humble origins of the ambitiously off-the-wall book.

"The main motivation was provided by a friend of mine, Peter Elbling. We were all sitting around trying to decide whether we should try to do something funny on the 1970s. When we really tried to think about it, we found that we couldn't remember anything about the 1970s, funny or otherwise. There were just these big blank spots. We reasoned that, if we couldn't remember anything about the 1970s, maybe we should just invent a decade of our own and look back on that one."

But structuring a suitable span of time proved not the batch of yocks the writers thought it would be. "You can't just invent a decade like that, you know," Hendra dutifully points out. "Usually these things take ten years to come up with. Frankly, after this book, I must say that I never want to see another decade again. We persevered, however, and it took us about four and a half

months from inception to the point of actually piecing together the decade in all its glory.

"The most peculiar thing that started to happen once we were working was that,

rather than taking the most obvious approach—the funny approach where you say *this happens like this because I want it to*—we began to actually construct a decade that real-



In 1984, the Third World Trade Center was mounted on the first and second Centers.

ly worked. If something happened in 1984 which had causes and results, everything had to be consistent. For instance, we had this one notion about California. Instead of the state being rocked by an earthquake, we had Los Angeles slide up the coast until it was opposite San Francisco. Subsequently, we received a piece about California becoming the first Hispanic state in 1984. Our slide occurred in 1986 so we had to go back and rewrite the 1986 piece, taking into account the Hispanic details. A reference to the Dodgers, for instance, would become Los Dodgers. That's just a very small example of the complexities that we got ourselves into.

"What we ended up finally doing was feeding all our major events and trends into a computer so we had a print-out in hand whenever we wanted to fact check or compare events."

Despite their orderly approach, the 1980s troupe did run into occasional snags concerning their subject matter, "We thought that the best way to do the book was to take trends and events that were of interest right now and extrapolate them to the point of absurdity. We wanted the book to have its feet planted in some sort of reality but, hopefully, with enough improbability to make people laugh.

"We did wind up debating some points, though. There was a big discussion between the editors over whether or not we should kill off Ted Kennedy. This was very seriously discussed along with all the various means with which we could bump him off should we choose to do so. Finally, we concluded that this sort of stuff was the thing that the present day *Lampoon* would do and we didn't want to take *that* easy a shot... although we did come up with some pretty amusing ways to kill Ted off.

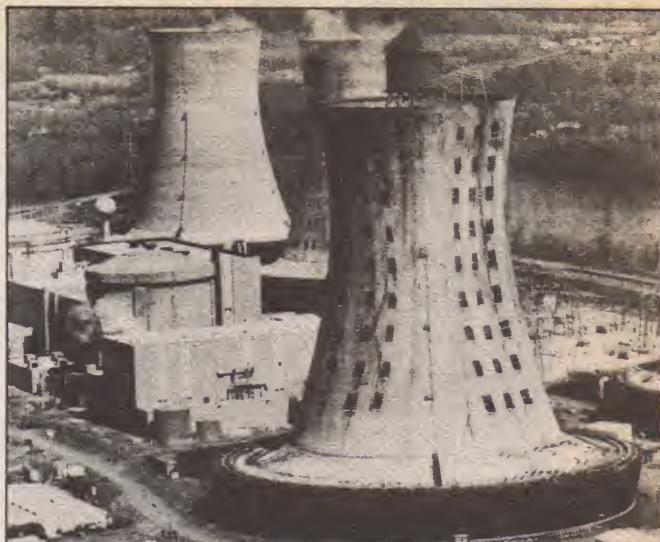
"I wanted him to be elected president but to have him put into office on a very strong capital punishment platform. His new law would be Federally approved and retroactive to about 1968, especially applying to vehicular homicides. My idea was that the President of the United States himself would wind up going to the electric chair. Nobody really bought that.

"We came up with an alternative plan. In order to gain blue collar votes, Kennedy appoints Dr. Allan Bakke as his medical advisor. Confronted with the problem of his wife Joan's drinking, Ted says that he'll do anything for Joan... anything. When her liver gives out, Ted offers to give her his own. On the advice of Bakke, he goes ahead with the operation and expires on the operating table. Bakke goes before the nation and says 'NOW I remember. It's TWO kidneys and ONE liver!'

"It was pretty funny but a bit too much. In the end, we came up with a compromise. Kennedy gives his liver to Senator Russell Long of Louisiana, who loves his bourbon, in order to get the Southern vote. He doesn't expire on the operating table but has to be sustained with the aid of a 15-ton artificial liver provided by Bakke. After ten days in office, Kennedy resigns."

In the 1980s, the "Back to Technology" movement flourished. Here, The Towers are constructed near Concord, Massachusetts.

Set in rolling countryside, this former "nuke" site will provide ample, spacious housing for disadvantaged members of society, offering built-in heating and lighting. Solitude is guaranteed.



The '80s is a book brimming with that sort of satirical punch. Science comes up with the solar electric chair. The Great Wall of China tours the U.S. The Kentucky Demolition Derby becomes the rage of the nation. Lloyd Bridges is worshipped as a major deity and the biggest fad in publishing is the magazine *Fred*: a publication designed for people named Fred. It is a tome chock-full of irreverent, thought-provoking, caustic humor. Yet, despite the book's range, Hendra doesn't feel that it's aimed over the head of the average reader.

"I don't think you can worry about that sort of thing," he says. "If, when you're writing, you're worrying about what pleases the teenagers, or the 18- to 30-year-olds or the one-legged, left-brained 33-year-olds, then chances are you will end up pleasing neither the people that you want to please or yourself. My attitude is that you should write what you think is funny. If you enjoy it, that feeling should convey itself to your audience. When

we wrote *Not The New York Times*, we had businessmen laughing at it as well as 18-year-old gumpers on park benches. The '80s should do that, too. It's a book that should appeal to grownups of all ages."

With the '80s now behind him, Hendra looks forward to reactions from fans and critics alike. His ultimate dream? "In the year 1990," he says, a glazed, visionary look embossing his face, "I'd like somebody whom I respect in the literary genre to step forward and say that *this* book is clearly one of the major works of literature in the 20th century. I don't know of anyone who would be crazy enough to say that, though. Well, my wife might say that. Norman Mailer might say that but no one would believe him. Hmm. Muhammad Ali, maybe."

Hendra furrows his brow and ponders the future of his book and literary criticism in general. "But Donny Osmond would be my personal choice... now there's a real man of letters."

## A Brief Look Back at the 1980s

**1980:** May 2—The Italian Government announced that it would start accepting kidnappees as legal tender. July 15—in their continuing push for equal rights, women insisted on a shorter average lifespan.

**1981:** Jan. 27—The First National Bank of Toledo was held up by a robber wielding a homemade atomic bomb. Oct. 10—The Checker Cab Corporation in conjunction with Runners World introduced a line of metered rickshaws to provide "healthy, economical, pollution-free" public transportation.

**1982:** Oct. 1—Worried by forecasts of a minute voter turnout in November, the administration announced that any citizen showing up at the polls would get a free toaster.

**1983:** Jan. 1—The United Nations International Year of the Simultaneous Orgasm began at midnight.

**1984:** Oct. 1—The Blue Cross/Blue Shield

Center for Disease Control announced that the main causes of Legionnaire's disease were: wearing funny blue hats, drinking quarts of bourbon, and holding conservative personal opinions.

**1985:** Oct. 2—A cure for cancer was discovered. All known forms could be neutralized by a substance secreted in the cranium of the baby harp seal, when it was struck repeatedly.

**1986:** May 28—The new Columbia School of Gossip mailed acceptances to 247 of more than 3,000 applicants.

**1987:** Disney, Inc. premiered the popular *Inner Wilderness Family* about a suburban family that flees civilization to homestead in the South Bronx.

**1988:** Feb. 29—Broccoli was declared an endangered vegetable.

**1989:** Jan. 17—Funds ran out in an ambitious project to develop the potatolo, a cross between a buffalo and a potato.

*Excerpted with permission from The '80s: A Look Back at the Tumultuous Decade 1980-1989, © 1979 Workman Press*

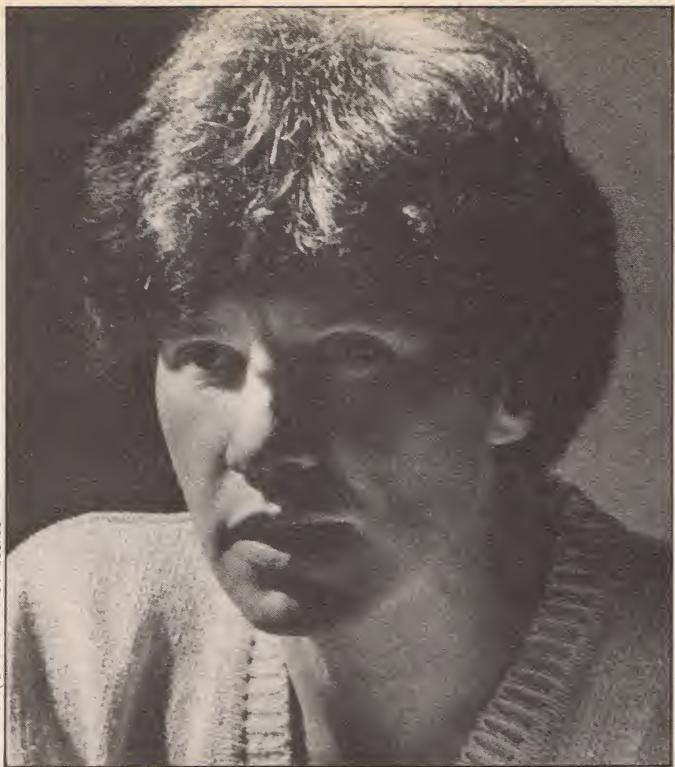


PHOTO: © 1980 CHRYSTALIS RECORDS

# Bernie Krause: Electronic Music Pioneer

By LOU STATHIS

Throughout his 25-year musical career, Bernie Krause has been searching. He has searched for new sources of inspiration—to give his music cross-cultural relevance and meaning; for new instruments—to realize the fullest potential of his music; and for new sounds—to extend the very boundaries and definitions of music itself.

His search took him from a small Detroit recording studio in 1964, where at 26 he was producer and guitarist for many early Motown soul hits, to San Francisco in 1966, where he and partner Paul Beaver pioneered the synthesizer's integration into popular music. And most recently his search has taken him to Glacier Bay National Park in Alaska, where he has recorded the sounds of whales and seals, both as source material for his music and as the required research for a PhD in Marine Bio-Acoustics (fish noises). Bernie's most recent album, *Citadels* (on the Takoma/Chrysalis label), is a vibrantly eclectic blend of jazz textures with Latin and African rhythms, inspired by L. Sprague and Catherine de Camp's study of lost cities, *Citadels Of Mystery*.

The astounding achievement implied by

Bernie Krause's long list of credits becomes obvious when you greet this quietly articulate and keenly intelligent man. Can someone of only 41 have accomplished this much, and still be as vigorous as he? His credentials are astonishing. He has contributed to dozens of movies, either as composer, arranger, producer or session musician. The list includes *Invasion Of The Body Snatchers* ("I did the pod screams," he says with a proud smile), *The Final Programme* (called *The Last Days of Man on Earth* for its U.S.A. release), *Performance* ("I sold Mick Jagger the Moog synthesizer pictured in the film and taught him how to use it"), *The Illustrated Man*, *Rosemary's Baby* and, with Francis Ford Coppola, *The Rain People*, *Finian's Rainbow* and *Apocalypse Now*. In television, he has variously contributed to *Batman*, *Mission: Impossible*, *The Munsters*, *The Wild, Wild West* and *Night Gallery*, while albums by the Beach Boys, the Doors, the Monkees, the Rolling Stones, the Tubes, Tiny Tim and others have featured him in one capacity or another (usually armed with synth). The preponderance of science fiction in this vast resume is no accident. Bernie is an avid SF reader, and says, "Electronics lend

themselves naturally to the effects of science fiction films."

Bernie played a pivotal role in electronic music as one-half of the ground-breaking synthesizer duo Beaver & Krause, who produced five albums from 1968 to 1973. Notable for their introduction of synthesizer into the traditional settings of jazz, classical and gospel musics, the albums are unfortunately all out of print, save one. The exception is the classic *Nonesuch Guide To Electronic Music*, which remains an invaluable reference and introduction, fully a decade after its release.

"Making an album was an educational process for me," Bernie says today. "I started recording everything Paul Beaver was teaching me at the time. I'd go to him, shove things in his face and ask, 'Is this what you mean? I'm putting it in a book.' And he'd have to think and work on it until it was exactly right. It took more than six months of pinning Paul to the wall to produce that record."

Beaver, who died suddenly of a stroke in 1975 at age 49, is considered one of the earliest and most influential of synthesists, thought by some to be second only to Walter (now Wendy) Carlos. "Paul collected electric organs, old Novachords and Hammonds, which in 1938 were the first synthesizers. He was a consultant to Hammond, and with his strong background in electronics and sound he was able to interface easily with the new synthesizer technology."

Bernie recalls Beaver with admiration and affection. "Paul was a real space freak," he says with a grin. "He used to climb naked up Mt. Shasta in Northern California, and wait for spaceships to land. He said the mountain was one of the Earth's seven points of focus for the 'interstellar machinery,' and he had actually seen extraterrestrial craft landing there."

Bernie's appearance is one of someone whose feet are firmly on the ground. He claims to be no technology buff ("I have difficulty plugging a socket-cord into the wall"), and indicates he came to the synthesizer via his restless, musician's curiosity. "I read about a composer in New York, Eric Siday, who had been given \$5,000 by American Express for one second of a commercial's recorded sound. I thought immediately, now there's something I ought to look into. I enrolled in an electronic music course taught by Karlheinz Stockhausen at Mills College in Oakland—and a whole new world opened for me. The synthesizer stripped all cultural influences from music-making (12 tone scales, etc.), and redefined music as, simply, the control of sound. When you build music from the ground up, as you do with a synthesizer, you can't avoid thinking of it that way. At least I couldn't." And Bernie hasn't stopped thinking of it that way, as the synthesizer has become a major part of his musical life.

Bernie regards his work on *Apocalypse Now* as another important moment in his growth as a synthesist. "Francis is a conceptual genius. He wanted music derived from the sounds of war, and he got four of the best

synthesists around to work hard at getting it for him. All of us—Don Preston [who has played with Zappa and the Residents, among others], Pat Gleeson [who has released two albums of his own on Mercury records, and owns Different Fur Recording Studios in San Francisco], Nyle Steiner [a newcomer from Salt Lake City] and myself—all had different comprehensions and approaches to the synthesizer. What resulted is something of a summation of current synthesizer technique and technology. I'm going to use what I learned there on my next record."

Currently, Bernie is amassing a library of marine mammal recordings, using a microphone devised by himself and a co-worker. He envisions using these recordings in congress with synthesizers on his next album. "I don't yet know what it'll sound like," he says, "but I guarantee it'll be different from anything you've ever heard before." Bernie is also at work on a new film score—one without synthesizers—for *Tell Me A Riddle*, directed by actress Lee Grant.

When asked about the future of synthesizers and electronic music, Bernie pauses thoughtfully. "There aren't many people doing new things with electronics," he observes. "Most synthesists are content to stumble across a couple of interesting sounds, and utilize them. There aren't enough real explorers and innovators out there. Nyle Steiner is one of those rare people—he's really a man to watch. He came into the *Apocalypse Now* gig with a thing the size of a flute case, and blew everybody's mind. He calls it the EVI—it works with air pressure and is valved like a trumpet, with a five or six octave range. Nyle is a man of the future."

"Malcolm Cecil is probably the genius of our time. He was responsible for *Tonto's Expanding Headband* with Robert Margouleff, as well as Stevie Wonder's synthesizer programming. And we're all looking forward to what Wendy Carlos does next; she's been silent for quite a while."

Bernie's thoughts turn to the future of our society, and his concern over the course it is taking. "I worry that we are an anti-intellectual country with no respect for its artists." Bernie sees our creative impulses stifled, and our culture stagnating. "Unless record company people are willing to take some risks and involve themselves in new concepts, new ideas, nothing's going to change." Bernie worries the most about the state of our environment, and his unique perspective gives added weight to his words. "The next thing we have to address ourselves to is the oceans. It's possible that vessel noises profoundly affect the feeding habits of the animals in Glacier Bay. Last year, there were at least 70 or 80 humpback whales there—this year I only saw one in a week. These animals are fast disappearing. I want to see them before they go, and I want to record them."

It's clear from the evidence etched in vinyl, and in the thoughtful concern of his words, that Bernie Krause is someone who bears listening to. His voice, arising from a seemingly tireless, searching intellect, is fresh, forward-looking and undeniably musical. **F**

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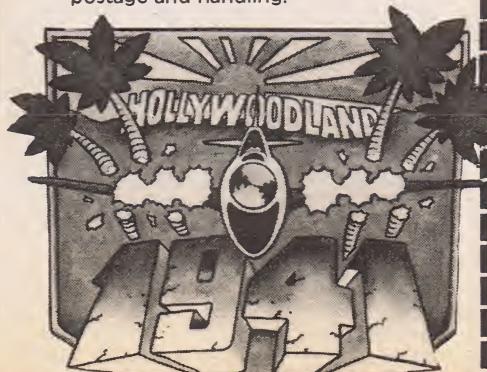
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From his top floor aerie 300 feet above New York City, author Isaac Asimov can stroll to windows and balconies fronting north, east and south, and absorb the contemplative possibilities inherent in distant horizons. During his creative hours, however, Asimov closets himself in a room devoid of daylight and pounds away at one of his four electric typewriters. Perhaps it is this stark environment that instills in his literary output an insistent, restlessly urgent quality rather than a serene one.

Isaac Asimov has just turned 60 years old. He has been writing professionally for 40 of those years. Thus far, his life's work adds up to over 20 million words between book covers and millions more in uncollected periodical form. His areas of expertise include hard science, science fiction, detective fiction, biblical interpretation, literary commentary, autobiography, history and limericks.

At present, he is working on a question-and-answer book entitled *Dialogue On Science*; a 100,000 word opus which starts with the query: "What is science?" In addition, two books on astronomy have also been contracted for. Clearly, Asimov is a man obsessed with work. As of this writing, he has penned some 215 volumes of Asimovia and shows no signs of slowing down—not even to celebrate a birthday.

In an article intended to commemorate his 60th year, Asimov was asked by FUTURE LIFE to gaze introspectively forward from this round numbered vantage point; to predict the scientific trends of tomorrow based on his observations of yesterday and today.

Seated in his Manhattan home, Asimov reflects on the nature of science and science fiction during his lifetime. Of the relationship between the two areas, he observes, "Science routinely prods science fiction. One has only to read the science fiction written in the late 1930s, when I began, to see how abysmally blind SF was to what was about to happen. Story after story talks about radium as the wonder metal of atomic energy. Not one talks about uranium. Story after story talks about robots. Not one talks about the computer. Science fiction is very occasionally prescient, but for the most part it is a humble follower of science."

While science fiction's popularity has soared over the years, Asimov sadly acknowledges that hard science has taken a drubbing in the popularity polls. "I'm afraid that the changes in the public's reaction to science has been an unhappy one," he says. "More and more people today distrust science and scientists, and use it and them as whipping boys. The most vocal anti-science blatherers use their stand as an advertisement of their own high-minded idealism and nobility, but I notice they make every possible use of technology where their own comfort is concerned. They use only the best public address systems and guitars (electrified when possible)."

During his 40 years of authoring both science fact and fiction, Asimov has watched the progress of science carefully but is admittedly hard-pressed to designate the

# ASIMOV

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## AT

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# 60

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To celebrate his birthday, America's master of science and science fiction ponders his illustrious past and looks forward to the future

By DANIEL E. BUTTON

"greatest" scientific advancement in his lifetime. "No one achievement is 'the greatest' beyond dispute," he states. "In my professional career, I should say that the following are in the first class: the electronic computer, the transistor, the laser, successful rocket probes. These are all technological discoveries rather than items of basic science—but the value of basic science is not easily estimated without the perspective of distance, while the value of technology makes itself felt at once."

As to the path science may or may not take in the future, Asimov is convinced that the answers to a great many of the Earth's problems lie in the promise of space. In Asimov's opinion, even the energy crisis can be solved via space science. "To overcome certain of the difficulties in capitalizing on solar energy," he explains, "why not have several solar power stations placed in synchronous orbit about the Earth, some 22,000 miles above the planet's surface, each one moving so as to stay, more or less, over a single spot on Earth's equator?

"A solar power station can receive the full range of the sun's energy, unblocked by atmosphere and atmospheric phenomena. It will be in Earth's shadow only two hours out of the 24, and when one is in shadow others

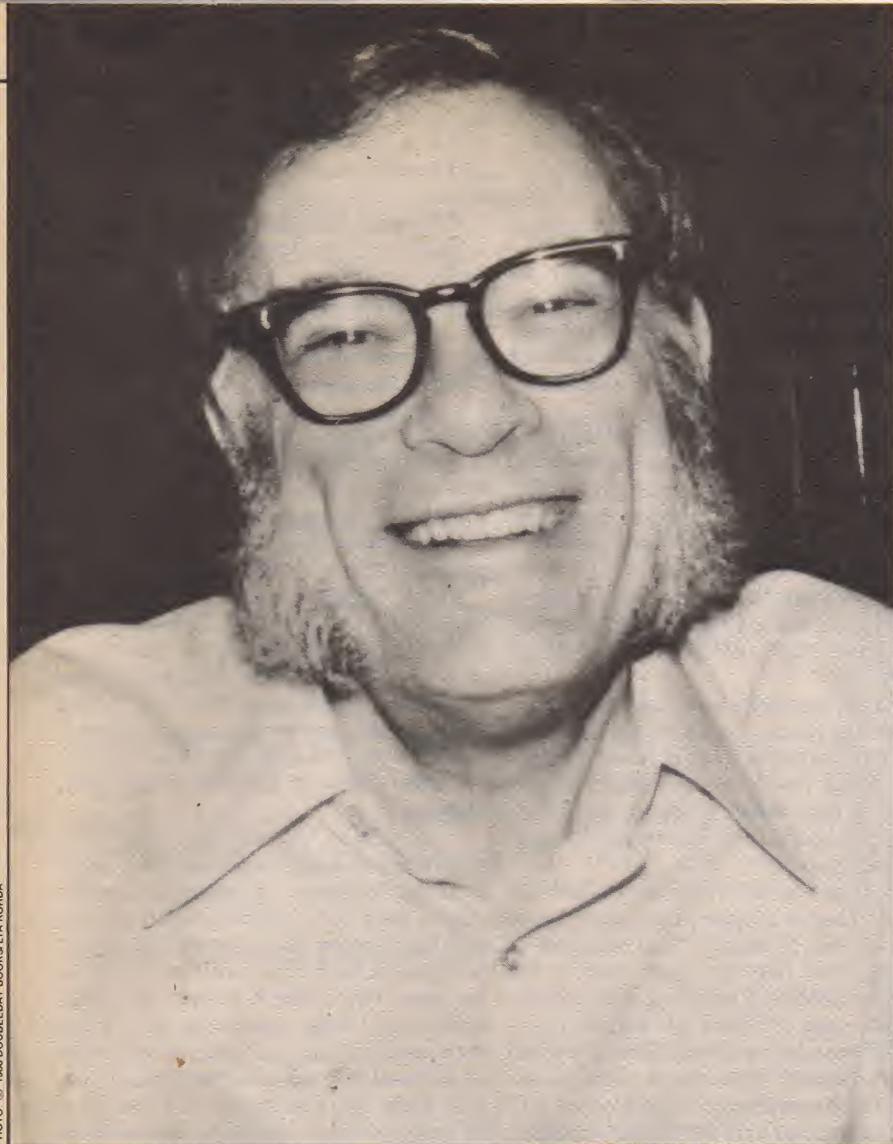
will be in sunshine. It can convert solar energy to a beam of microwaves, which can be picked up and used with much greater efficiency than sunlight itself can be, so that the collecting areas on Earth's surface will be much smaller and more easily maintained than otherwise would be the case.

"But we should realize that energy stations in space will give us something much more important than even energy.

"All forms of energy obtained here on Earth are geography-bound. Just as there are oil-rich regions and oil-poor regions, so some regions are richer than others in tidal energy, in waterpower, in geothermal energy, in uranium supplies, in access to the ocean. And while that is so, the temptations to rivalry may be impossible to defeat.

"Space, however, is equidistant from all surface-regions. Energy drawn from the sun in space would belong to all people in a fashion that no Earth-bound energy source possibly could. The power stations in space would, in a sense, breed cooperation.

"The techniques developed for building such stations could be used to build other structures in space. There could be space observatories for the study of astronomy and other sciences; space laboratories where dangerous experiments in nuclear physics and



genetic engineering could be conducted with little risk to Earth itself; factories that would take advantage of peculiar properties in space to carry on industrial procedures difficult or impossible to accomplish in Earth's surface environment.

"Building materials for these observatories, laboratories, factories—and settlements, of course—could be obtained almost entirely from the Moon. For the foreseeable future, at any rate, the Moon is an inexhaustible source of material of all kinds (except for hydrogen, carbon, and nitrogen). What's more, the Moon is without a native ecology we might otherwise hesitate to disturb.

"Let me also mention three great ultimate consequences that may result from our space activities, aside from obtaining energy and gaining world cooperation:

"First, we can expect that eventually there might be enough space settlements to permit a new growth of human numbers, after that growth has come to a halt—as it must in the near future—on Earth's surface.

"Second, more and more of Earth's industry eventually will be lifted into space, where the problems of resource depletion—thanks to the Moon—and of pollution—thanks to the great volume of space—will be far less important. With industry on Earth's

surface shrinking, that surface might return to a more desirable wilderness/park/farm condition. What's more, we would restore the beauty of the Earth without losing the material advantages of industry and high technology.

"And finally, the people of space settlements eventually would serve as the advance guard of humanity in the exploration and settlement of farther reaches of space."

Asimov believes that space colonization will improve the quality of the human species. "People, living enclosed in small worlds and accustomed to space travel, would have far fewer psychological problems in making long space flights than would people who have been brought up under the space-alien conditions of Earth's surface. You will see the importance of this if you remember that the advance of humanity up to now has come about, after all, through the steady increase of its range over the face of the Earth. With this has come a steady increase of sophistication in methods for its transportation and communication and the steady increase of its ability to make use of the laws of nature for its own purpose. But the Earth is filled now; over-filled, indeed, and we can do nothing more if we must remain confined in the straight jacket of the planetary surface. So, as

I see it, we must therefore expand again—toward the unbounded horizons of space."

Dr. Asimov pauses to note that the revolutionary increase over the past 30 years in the knowledge of our sister planets has not been cheap. The instruments that have made the revolution—the radio telescopes, the computers, the rockets—have cost enormous sums, he acknowledges, adding that virtually all of it has come out of the public's pocket.

"So," he observes, "it is only human for us to question the value of the results. To be sure, it is reasonable to speak of the itch to satisfy curiosity and of the value of knowledge for its own sake. But it's the scientists whose curiosity is satisfied and who appreciate the knowledge—and it's the non-scientific public that pays. Scientists, therefore, need to be patient when the public asks 'But what's in it for us?' especially since good answers can be given to the question.

"For example, we have spent billions in reaching the Moon. Just one result is the return of rock samples from the lunar surface. They are immensely valuable from the standpoint of an insight into the early days of the solar system.

"The Moon offers us a tool that allows us to probe backward into the first half-billion years of existence of the solar system. It is this expertise that can—and I believe will—make it possible for us to return with the more down-to-Moon purpose: the mining station that I have spoken of. And a century from now no member of the 'public' will ask of what value it was to reach the Moon. The answer will be all around, with humanity's range spread from here to the Moon, and human prosperity and further advancement entirely dependent—as I have been suggesting—on space technology.

"And roughly similar advantages are possible, by the way, through our probes of Mercury, Venus, Mars and Jupiter. In the case of Venus, for example, remember that we are increasing the carbon dioxide content of the atmosphere slowly by burning coal and oil, and this may be warming Earth slightly. Is there a point at which we will set off a runaway greenhouse effect and gradually, but inexorably, turn Earth into another Venus, where the surface temperature approaches an unbelievable 500° (C) on all parts of the planet? It may have been a 'runaway greenhouse effect' in the long-distant past that converted a much milder Venus into the hell it is today. I believe that if our studies of Venus enlighten us on this matter, we may learn enough to save humanity and keep Earth a life-bearing planet.

"In fact, it may be that the answer to weather prediction and weather control here at home will depend on the data we get from worlds that are tens and even hundreds of millions of miles away.

"Further, if we learn the intimate details of the chemical structure of Jupiter, we will perhaps know more of what it is that is going on in the center of our sun—and that, in turn, may help to save our civilization from disaster in times to come."

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In the slightly more than a single decade since humankind reached the Moon, Asimov continues, we can be considered as being in a time of preparation for a new phase of space exploration.

"In this new phase, with cheaper hardware and longer shifts for those reaching space, we can begin to build those new industries, new settlements—and new visions.

"It is not just a matter of human beings traveling here and there. While the universe waits for the foot of humanity, it can be invaded by the human brain.

"We'll have to understand how long people can remain on the Moon at one-sixth normal gravity. In fact, if we're going to be dealing seriously with space, we'll have to know how long people can endure living and working at zero gravity.

"If low gravity can be endured for only a short period this will put an enormous constraint on the future of space exploration and exploitation.

"So far, astronauts have remained in space for as long as three months. Human beings probably can stay in space at zero gravity for even longer stretches, but even if they couldn't, three-month shifts would be adequate and would enable space construction to proceed smoothly."

Looking deep into the future and into the farthest reaches of space, Dr. Asimov poses some far-out prospects: "Can we consider ourselves the only intelligent race in the universe capable of launching itself into interstellar space? What if our asteroid belt is already occupied by others? What if we find we are penned into our own inner solar system with everything beyond blocked off?

"These appear to be very unlikely propositions, of course, on the basis of chance alone. Space arks, moving randomly, are not very likely to stumble upon our star, and the likelihood is that we have escaped.

"Even if some asteroid-ark of another system has encountered our planetary system, any race capable of interstellar travel may have enough respect for intelligent life to avoid exploiting the asteroid belt of any star that possesses a planet with intelligent life. And presumably mankind's own asteroid-arks will practice similar restraint.

"But then what if a human asteroid-ark encounters another asteroid-ark and finds, on a close approach, that it is occupied by intelligent beings of utterly different antecedents? Non-human altogether—what then?

"A genetic interchange would be out of the question, but might not the intellectual cross-fertilization be all the richer, if it could be managed at all?

"When human beings venture into the wide universe they may find it already inhabited by a vast brotherhood that does not take into account the differences in the material body, but asks only that the organization of that body be complex enough to support a high intelligence—as it must in that brotherhood, or the asteroid-ark would not have been possible in the first place."

Of the potential projects toward which the world will be heading in the next several

years, Dr. Asimov believes the progress to be made will depend, in part, on the extent to which nations are willing to spend on space and survival rather than on "defense" and doom.

"Assuming rationality and wisdom," he explains, "we should expect that one of the earlier space projects will be the construction of a large telescope in space. It could be tended, when necessary, by rotating teams of astronomers taken to the telescope and home again by the space shuttle.

"If the space telescope is successfully deployed, it should be quite capable of answering some of the questions about the overall fate of the universe. I have two guesses I would like to make in this connection about information to be gathered following the placing of the space telescope into operation:

"First, I suspect that quasar studies will establish beyond doubt a cutoff somewhere this side of 15 billion light-years. Beyond the cutoff, we will be probing so far back in time that only the high-energy haze that existed immediately after the big bang would be visible. This would be a final confirmation of the big bang theory of the beginnings of the universe.

"Additionally, a detailed study of globular cluster and of clusters of galaxies will make it clear that the masses of major astronomical objects have been seriously underestimated and that, in general, interstellar gases and intergalactic stars represent a large fraction of the mass of the universe. In short, we will be on the way toward discovering the 'missing mass' and deciding that the universe is closed after all—that it will someday begin to contract again, and that the big bang that set us all going was only one of an endless series stretching back to the indefinite past and forward to the indefinite future."

As for his own future, as he turns 60, Dr. Asimov is far less "indefinite." He regarded it as a "triumphant" occasion personally, having felt "upset" at 40 and "neutral" at 50. Having survived in good style a coronary three years ago, he first found it difficult "to regain the old feeling that I was immortal." Completion, however, of *In Joy Still Felt*, the second of his autobiographical volumes, brought the feeling that "somehow nothing is ending—that I can go right on. It's a pleasant plateau." Adding to his sense of satisfaction was his promotion to the rank of full professor in biochemistry at the Boston University School of Medicine.

"The older I get, and the more books of mine that are finished and in print, and the more backlog of royalties accrues, the more impelled I feel to do books that I really feel like doing. This has led, for instance, to an *Annotated Gulliver's Travels*. More significantly—and bridging two of my interests—is an analysis of the first 11 chapters of *Genesis*, down to Abraham. I am comparing these, verse by verse, with modern thought in cosmology and archaeology."

Scheduled for publication later this year, this book will bear a title quite typical of the fruit of all the Asimovian questing: *In the Beginning*....

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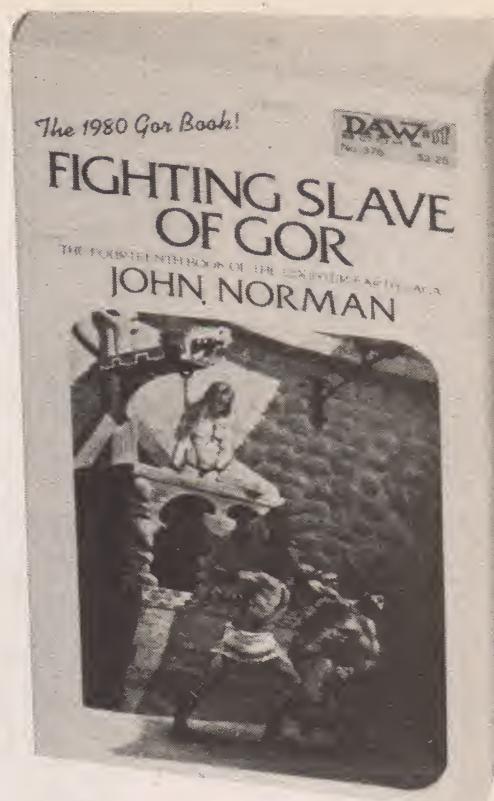
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## PORTFOLIO

# Don Dixon

By BARBARA KRASNOFF



**A**lmost as far back as I can recall," muses space artist Don Dixon, "I've been interested in astronomy and space exploration. My first attempt at abstract thought was a theory I formulated when I was two and a half to explain the Moon's apparent lack of parallax when observed from a moving car; e.g. the Earth rotates under the wheels of the car, so car and Moon are fixed with regard to one another." He grins. "Subsequent observations pointed out flaws in this theory."

From this promising beginning, Dixon went on to become one of the top ranking artists in the field of space art. His realistic and detailed spacescapes ("A registered trademark," says Dixon. "My sole claim to glory is having invented the word back in 1972.") have been seen in magazines, books and films since he became a freelancer in 1972.

His interest in astronomy and space exploration go back as far as he can remember. "The earliest drawing I can remember," Don relates, "was a crayon sketch of a fireball meteor, this done about age three (and how I wish someone had saved it!). It was a typical space buff's upbringing: building telescopes, reading and re-reading Heinlein, Clarke and Asimov, trying to figure out how I could be a part of it all. Ask any fan... By the time I was eight I was fascinated with science in general and astronomy in particular, and wanted to be an artist." However, even with his early artistic aspirations, Dixon actually decided to become a full-time space artist almost by

default. "I was planning to become a professional astronomer," he says. "After three years of majoring in math, physics and astronomy, I decided that was not where my interests lay exactly. I just didn't want to go through the academic grind. So I started getting into artwork. I put out a series of slide sets, and they sold quite well. And gradually I started getting private commissions, some cover assignments."

Since then, Dixon has produced a steady stream of his spacescapes, appearing in such publications as *FUTURE LIFE*, *Astronomy Magazine*, *Scientific American* and *The Magazine of Fantasy and Science Fiction*. He has illustrated the first two books in T.A. Heppenheimer's space colony trilogy, *Colonies in Space* and *Toward Distant Suns* (the latter excerpted in *FUTURE LIFE* #15), and hopes to also work on the third.

Don has also done work for films; notably as animator for NASA-backed productions such as *Jupiter Odyssey* and *Descent to Venus*. His latest venture in the motion picture industry was turning out preliminary spaceship designs for Roger Corman's forthcoming film epic, *Battle Beyond the Stars*.

One of the major factors behind Dixon's success may be the care he puts into each of his space paintings. They are carefully planned and mapped out, to give the viewer the best impression possible, according to known scientific facts, of what a planet or galaxy could look like from close up. Using his background in math and physics, he cal-

"Sunrise on Titan,"  
Don Dixon's portrait  
of Saturn as seen from  
the surface of its  
largest moon. Dixon is  
well known for the  
care and research he  
puts into his astro-  
nomical art; going by  
known scientific facts  
he gives us a view of space  
that most of us  
will never see in  
person.

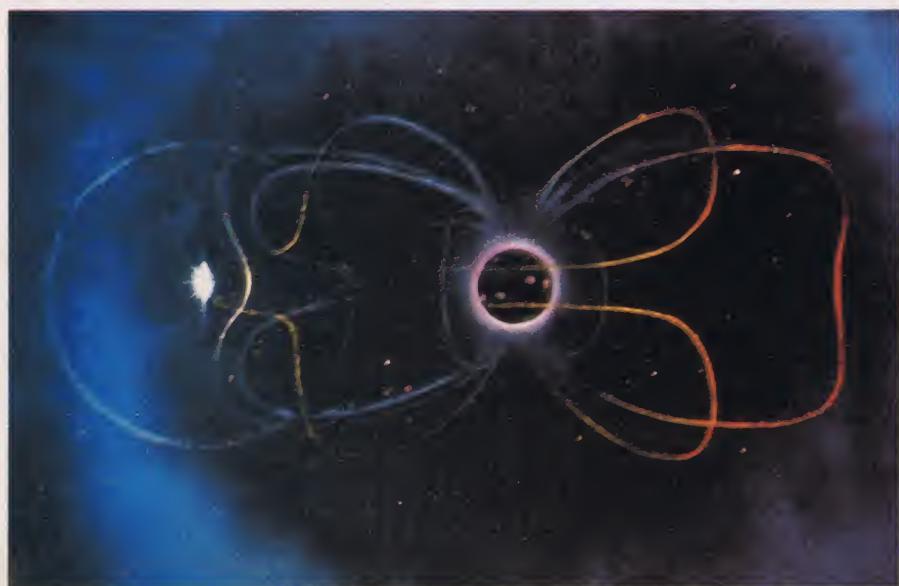




culates the position and size of his subject as it would appear in relationship to the space voyager's point of view before embarking on each new work.

However, Don asserts that it is not all that difficult to figure out how an outer space landscape will look. "Actually, that's the easiest—if there is enough data. It's a lot easier to render something that passes as real if nobody can prove you wrong. For instance, the planet of another sun is wide open. But, because of the bulk of the photographs, if you want to do something like the surface of Mars, it has to look like the real thing."

But no matter how hard an artist tries, when dealing with something as uncertain and unknown as space, factual inconsistencies are bound to appear as more and more information becomes known. Dixon's space-scapes are no exception. "All my Mars pictures are wrong," he admits. "I had a blue sky. As early as 1969, scientists should have





ART: © 1980 DON DIXON

Far left, top: "Antares Rising." A far-off hypothetical planet slowly thaws after a long ice age; in such conditions, there is the possibility that life may develop.

Far left, bottom: "The Crab Nebula Pulsar." A model of a neutron star. The colors are caused by radiation given off by protons and electrons moving at almost the speed of light.

Left: "Interacting Galaxies." Viewed from the surface of an Earthlike world, two galaxies drift slowly past one another.

Below, top: "Sunjammer." An example of one of the ways humanity may sail the stars in the future. The sunlight-driven sail is made of aluminized plastic film.

Below, bottom: "E.T. Horse." The animal peacefully grazing in the foreground is totally unaware of how strange his world seems to his Terran audience.



known that Mars would have an orangish kind of sky. They had the data, but nobody bothered to look at it. So they had us rendering Mars with a blue sky until 1976. In fact," he grins, "in the first Viking color photographs of the Martian surface, they tinted the sky blue. Finally somebody looked at the data, and figured that all their preconceptions were wrong."

Realism in his spaceships is quite important to Dixon, both artistically and philosophically. "I think my work reflects my beliefs," he says. "I try to depict the unknown as honestly as I can, with what facts are available, and if I can communicate some of the joy of exploration and discovery, I'm satisfied."

"I also have a sort of missionary zeal to educate the natives," he confesses. "I'm constantly running into turkeys who regard space exploration as 'weird.' They usually tell me this after asking what my sign is. They don't know how many planets orbit the sun, or the





difference between a solar system and a galaxy, and yet they're allowed to vote and raise children.

"The ignorance of the average person about natural processes and the scale of things is frightening. If, by painting a realistic and pretty extraterrestrial landscape, I can convince someone, on the gut level, that those lights up there are in fact real estate—places to go and learn and perhaps live—then I may be accomplishing something useful."

Don's dedication to the education of his audience is evident in the detailed descriptions of his paintings which he includes with his slide sets. He describes the painting, the rationale behind his representation of the scene, and the angle at which the viewer is observing the planet. For example, his description of his painting "Sunrise on Titan" (seen on page 59) reads as follows:

"A crescent Saturn hangs fixed in the sky of its largest satellite at the end of the eight-day-long Titanian night (tiny Janus is seen in transit against the highly oblate disc). Titan has the distinction of being the only moon in the solar system definitely known to have an extensive atmosphere (of methane, at a brisk 200 degrees below zero), thus the sky would be blue rather than black, and the ground might be frosted with frozen water and carbon dioxide. (Visual angle 22 degrees)"

Or his explanation of "Antares Rising" (page 61):

"View from a hypothetical planet orbiting eight billion miles from the type M supergiant. During Antares' cooler youth this planet would have been locked in ice, but as the sun exhausted its hydrogen and progressed to more energetic reactions (incidentally consuming any inner planets), this world would have thawed, and conditions might have become suitable for the development of life. (Visual angle 24 degrees)"

One way to produce the ultimate realism in space art would be for the artist to see his subject in person, from, say, a space shuttle. Would Dixon go up if he had the chance? "Oh, I'd love to," he says immediately. "I have a secret fantasy that sometime around 1983 or '84, NASA will do a public relations flight and take science fiction writers and space artists for a ride. I think that would be wonderful. Barring that," he concedes, "I'm hoping to save up enough money to buy a ticket."

"I imagine that when we finally do get into interstellar travel and start visiting other planets, seeing some of the things that are really out there, most of our ideas will look pretty tame. Reality is always far more fantastic than anything we can dream up."

Concerning politics and philosophy, Dixon admits, "I can't resist an opportunity to sound off. Politically, I'm a libertarian... with some reservations. I think people should be free to manage their own lives and businesses as they see fit, so long as they don't step on anyone's toes. The only things governments do well are to start wars, botch up economies and provide legal mechanisms to maintain slavery and oppression.

"Unfortunately, most people would rather



"Eclipse Seen From Ganymede," a solar eclipse as seen from the largest Jovian satellite. Opposite page: "Commuter's Fantasy"—the future of the superhighway?

be told what to do and think than make any effort to formulate their own values (the fact that they tend to buy the first religion they're offered, rather than shop around, points this out). Given their druthers, the people will almost always opt for some kind of slavery. Look at Iran.

"So until we can create more rational human populations—say through the selection pressures of space migration/colonization—I think we need some form of semi-representational government.

"Philosophically," he continues, "I'm a rationalist. People have been trying to change reality by praying to it for thousands of years, and for all those years their lives have been brief, squalid and savage. The scientific method (which Phillip Wylie has aptly defined as 'applied honesty') is the only approach to existence that has done anything to improve the human condition. I think the mystical approach is bankrupt, and I have no patience for it.

"I have to depart from the traditional rationalist's stance, however, in that I do believe there are some ultimate questions with which our minds are not yet able to deal. I don't have enough faith to be an atheist. Religions do address the big questions, but the answers they come up with are so dull, tame and unimaginative that they must almost certainly be wrong. I prefer to keep looking. I think that's what being human is all about."

And while he is looking, Don Dixon is

keeping himself very busy. "My current project, a very exciting one to me, is a book I've been doing which is tentatively titled *Space-scapes: A Pictorial Guide to the Universe*, to be published by Houghton Mifflin late this year. It will contain about 100 space paintings and 150 photos from observatories and Apollo missions. I'll be writing and illustrating the book, putting it together. It should be quite a project."

In addition, he is working on four limited edition prints to be published by Sunrise Publications, which also puts out a series of eight greeting cards by Dixon. U.S. Posters will be issuing eight more of his posters along with some spacescape puzzles. And the California artist may be making a move to England to paint mattes for a *Dan Dare* television series, based on the popular British comic strip.

All in all, Don Dixon may be described as the epitome of a space artist. In fact, "I think if there is a god," Dixon asserts, "he is an artist. One of the things that does fascinate me is that the universe is so beautiful. Every place you look, even the most primitive cultures have an aesthetic response to nature. That amazes me. It's the closest I can get to mysticism, seeing the order and beauty of everything from a snowflake to a spiral galaxy."

"That's sort of what I try to convey in my art; an appreciation of that. I'm sure all artists do."

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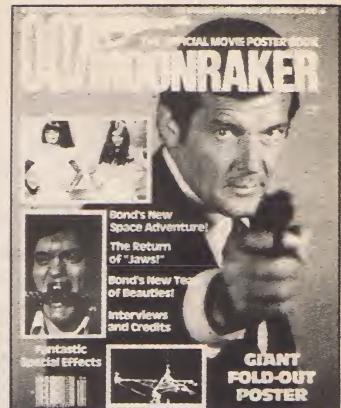
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## Connection

(continued from page 36)

gramming. Polls taken to find out what the public wants more of consistently include more science and more wildlife. To date, the *National Geographic* brand of wildlife/natural history has run off with nine of the places on PBS's Top Twenty. The highest-rated program ever was *The Incredible Machine*, a *National Geographic* special which featured photography inside the human body. This had a rating of 16 percent, well over the average prime time rating for PBS of about two percent. The two British productions which made the listing are *Einstein's Universe*, in ninth place, and *Upstairs, Downstairs*, at #16. (For the record, *Live from the Grand Old Opry* was #2 and the four part dramatization of Nathaniel Hawthorne's novel *The Scarlet Letter* was #3. PBS, however, points out that they haven't rated every PBS show, only those that appeared during the ten weeks of each year when ratings were taken.)

*Nova's* polls reveal that its most popular program this season was a repeat of *The Case of the Ancient Astronauts* (a BBC/WGBH co-production; producer Graham Massey), which is about von Daniken's theories. *Life on a Silken Thread*, the German film adapted by Sari Sapir, and *Race for Gold*, a film about the technology of Olympic sports training made in-house by Paula Apsell, also had excellent audience response.

In British broadcasting, meanwhile, one series stands above the rest, the grandad of science documentaries—*The Ascent of Man*. "With hindsight, this was probably the most truly popular science series we've ever had," says Paul Bonner, head of the Science and Features Department which produces most of the BBC's science programs. "When it was first shown, it didn't get great viewing figures. But a work like that builds a certain audience loyalty, and it got better figures when it was repeated. It will probably show on Earth till the end of time."

Carrying on the Bronowski tradition, the BBC has since produced numerous science series, although several have yet to reach American audiences. Last year, BBC-1 showed *Life on Earth*, David Attenborough's history of nature, which took three years and one and a half million miles of travel to film. Warner Brothers, who co-financed the 13-part series, are currently offering it for distribution in the States. Nigel Calder's *Spaceships of the Mind*, a cosmic look into the 21st century, is eagerly awaited by space buffs. This co-production by the BBC and OECA, Toronto, has been broadcast in Britain and Canada, and the BBC seems confident that it will play in the U.S. Paul Bonner describes the three-part series as "a fairly advanced view of science which in a curious way only the young people in Britain really relish. Older people tend to think it's too far-fetched. But in America you don't have that attitude."

Certain programs from the BBC's Science and Features Department never reach American shores, such as BBC-1's *Tomorrow's World* and son of *Tomorrow's World*, called *The Risk Business*. The parent show has an average weekly following of over ten million or about 24 percent of Britain's television audience.

*Tomorrow's World* is a 25-minute, popular magazine program which reports on the development of things to come. "We examine about seven items a week," explains editor Michael Blakstad, "with a brief comment on whether we are for it or against it. Typical subjects include how to paint transfers onto your car using infrared transfers; voice recognition by computers; an astonishing new car designed by an Italian called Luigi Coloni; and sites for radioactive waste in Britain."

*The Risk Business*, a 40-minute program which comes out 13 or 14 times a year and is now in its fifth year, takes one of these items and goes into it in depth. "It vents, if you like, the frustration of *Tomorrow's World*," explains Blakstad. "It follows a product all the way from the conceptual stage to the laboratory and into the shops, and looks at the good and bad things that can happen when you try to innovate an industry."

At the moment, neither of these programs goes to the U.S. because there's no slot for them, according to Michael Blakstead. "We've been approached dozens of times by PBS, but their hands are tied by the American sponsorship laws, and you've got to have a backer, even on PBS. The law says that commercial backers must not have any semblance of editorial involvement in the programs, and since a lot of what we do inevitably involves companies, you've got Catch-22. If we feature the company that's sponsoring us, we run up against the legislation, and if we feature its rivals, the sponsor wants to know why he's paying." (The BBC is free of advertising considerations, since its main source of funding is TV licenses.)

"We rely on the work that's being done in all kinds of laboratories, including industrial labs. If we had to exclude what's being done by industry, which is what would happen in the States, then we'd have a poorer program. But we are talking very hard with WNET about the possibility of co-production, though it would probably be more scientific news, and leave out the gadget-oriented side of the program."

It's not just the law that dictates what can be shown on American television—there's also the sensibilities of the American public. According to *New York Times* television critic John J. O'Connor, there's still one big no-no on American TV: the penis. So it's hardly surprising that the *Horizon* program, "The Fight To Be Male," was not picked up by PBS: it discusses gender and sex differentiation and shows genitalia on-screen.

Meanwhile, the business of buying and selling programs continues. In fact, as WGBH's Mick Rhodes tells it, "There's almost an international trade in TV science programs, which is not surprising, because

they travel quite well, unlike wine. They just suffer a bit sometimes in translation."

It's not just American public broadcasting buying from its trans-Atlantic cousins—it is a two-way street. The BBC showed "Still Waters," which was made for *Nova* by Peace River Films; *Horizon* bought *Nova's* "Race for Gold;" and the purchase of several other *Novas* is under consideration. "Aunty" (as the BBC is known on its home ground) also bought the first two episodes of a new anthropology series, *Odyssey*, and has an option on the forthcoming *Cosmos*.

"We put up our money before they actually started filming," says BBC's Paul Bonner, "after looking at the scripts and the filming techniques, which include a cosmic zoom from the edge of the universe rising to find planet Earth. Also, the caliber of the people involved—producers Adrian Malone and David Kennard, and Carl Sagan, who is very popular in England—guaranteed the sort of program that was worth us having an option on."

Looking ahead, PBS has a lot of new, homegrown material on the horizon that's being made stateside as American programmers discover that BBC-type science shows are fundable in the U.S. *Odyssey*, a brand new series of 12 hour-long programs on anthropology, made by the Boston-based Public Broadcasting Associates, begins Sunday, April 6. It's the brainchild of *Nova* alumnus Ambrosino, who stresses that *Odyssey* is complementary to *Nova*, not competition for it. The series will look at how human beings interact, how culture is formed and how it shapes us.

The first show, called "Seeking the First Americans," was filmed at all the major sites in question in the U.S., as well as the Yukon, where people are trying to find bone tools and are dating man 40,000 to 60,000 years ago. "The program features one of the most adventurous anthropologists, Dennis Stanford from the Smithsonian," says Ambrosino, "and the man he would like to convince, Vance Haynes from the University of Arizona." So, bone tools or no, sparks should be flying.

*Nova* has a string of programs planned for next season, including an intriguing one produced by Veronica Young about maleness and femaleness, and the way they are related to the way you raise, treat and educate your children, not to mention the expectations you have of them even before they are born.

At WGBH, Jo and Francis Gladstone have made a pilot and are seeking federal funding for a series on *Tales from Medical History*. The pilot, called "Ephraim McDowell's Kentucky Ride," is about a surgeon in 1810 who performs the successful, pioneering operation on a woman who has an ovarian tumor. (The Gladstones, a married couple working on their first project together, are BBC Science and Features exports. Both have worked on *Horizon* and *Nova*, though never concurrently, and Jo was chief researcher on *The Ascent of Man*.)

Among the science programs planned by WNET in New York is a big new series on the

human brain, which is currently being developed by another expatriate Englishman, Richard Thomas, and may be produced in conjunction with the BBC.

The National Science Foundation's Public Understanding of Science Program, which is designed to increase the science literacy of the American public, is spending \$4 million in 1980 on science communication, with more than half of it dedicated to broadcasting activities. The Program already has *Star Date*, a radio series on astronomy aired nightly on 350 radio stations. It is the principal funder of the Children's Television Workshop's 3-2-1 *Contact*, the new daily half-hour science program for children from 8 to 12 years old, which was launched January 14 nationwide.

On the regional level, Jeffrey Kirsch, director of the science group at KPBS in San

Diego, has been producing a TV program called *Synthesis*. It's a cooperative venture, led by KPBS but involving other west coast public broadcasting stations. Working on a yearly budget for four programs that is comparable to the budget for one *Nova* program, *Synthesis* doesn't pretend to be on the same scale as *Nova*.

George Tressel, director of the Public Understanding of Science Program which funds the project, explains: "The value of *Synthesis* lies in its being a regional program, designed for local audiences. It deals specifically with local issues, such as water allocation and the impact of oil spills on west coast ports. We've also recently funded a second project with the Southern Educational Communications Association (SECA) that's going to be run on similar lines out of Atlanta. Again, it deals with local issues, which in the case of the south-east means things like strip mining and coal delivery."

But projects such as these are vital in another way. "They provide an excellent opportunity," says Tressel, who voiced a familiar cry from the American science community for more qualified science producers in the U.S., "for people to learn and develop science programming on a modest scale, before gradually moving on to the major budgets and operations of national programming."

Meanwhile, the BBC's Science and Features Department has planned several new series for the '80s. BBC-1 will feature *Report*, a brand-new series reporting on controversial topics in the scientific world. James Burke's series, *Connections*, will deal with current preoccupations with philosophy and recent research into the workings of the human brain. On BBC-2, the two big new series are *The Search for Man*, a six-part documentary series in which Richard Leakey examines the origins of man, and a seven-part drama series about Robert J. Oppenheimer and the building of the first atom bomb, produced by Peter (Marie Curie) Goodchild.

The Oppenheimer series is already well into production, with locations in London and the U.S. There won't be a lot of straight science in it, according to Peter Goodchild, "but basically you will know the principles of the atomic bomb, which isn't that difficult to figure out." At any rate, the series promises to be quite something, given Peter Goodchild's track record in docu-dramas and the popularity of the subject, and WGBH is currently in the midst of negotiations to purchase it.

Of the other new BBC series, it's likely that the Leakey program will reach the States (when you've made the cover of *Time*, you're in with the American public) and James Burke's new series will probably be snatched up after the recent popularity of his *Connections*. For a time, there should still be a healthy chunk of BBC science material coming to American television.

There's also the possibility of more British science documentaries appearing on the new cable-television network planned for hook-up this spring by Time-Life Films. The new channel, to be known as BBC in America, will concentrate on prime-time broadcasting of first-run BBC productions in light entertainment, drama, action-adventure and documentary. At this point, there is no slot specifically designated for science. Time-Life Films, which distributes all BBC programming in the U.S., has taken great pains to assure American viewers that the new network will not affect current methods of distribution on PBS, via such programs as *Masterpiece Theatre* and *Nova*.

With the BBC gearing up for a continuing import effort in the next decade, it seems safe to say that the British influence will still loom large in science documentaries on PBS. But the seed has finally been sown for more home-grown stateside science programming in the 1980s.



Odyssey's Michael Ambrosino

Diego, has been producing a TV program called *Synthesis*. It's a cooperative venture, led by KPBS but involving other west coast public broadcasting stations. Working on a yearly budget for four programs that is comparable to the budget for one *Nova* program, *Synthesis* doesn't pretend to be on the same scale as *Nova*.

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F18

# Flash Gordon

(continued from page 33)

moment's notice. But he confesses to being pleased with that sort of a workload. "The thing that I find challenging with this movie," he explains, "is that it involves every type of special effect there is. This is also the first movie ever to use an electronic optical printer. We've been working on the prototype for 12 years, but this is its debut. The printer brings together the best points of electronic and film special effects. We now can process film the same way we do with video. What I mean is this: With video, you have the advantage of being able to break the picture down into electronic signals. You can then modify the signals to create marvelous effects. You have complete control of an image when it's reduced to a signal. You can instantly see what you're doing to the image because you can view it on a monitor. With the electronic optical printer, we break the film down into those types of electronic signals. We alter the signals, view it on a monitor and, after we've gotten the finished picture we want, reconvert those signals into a finished image and then record that image on film. The result is the best image you can get on film for an effect."

Although Van Der Veer and his crew seem content with knocking themselves silly concocting visual whammies, the production itself has had anything but a happy history. Planned over two years ago by DeLaurentiis, *Flash* was stalled for quite some time while the script was feverishly worked and re-worked, and DeLaurentiis battled over creative control with the original director, Nicholas Roeg. Finally, Roeg departed, Hodges stepped in and the carnival came to life. Even after shooting had started, however, film industry insiders expressed open skepticism about the project's future. DeLaurentiis did not even have studio backing when the cameras began rolling... practically an unheard of practice in these days of megabucks production. Since that time, distribution has been found, with Universal handling the job in the U.S.

Van Der Veer considers the producer's eccentricity a plus factor, despite DeLaurentiis' detractors' views. "He's totally unique," the effects master laughs. "I've been in Dino's good graces ever since *King Kong*. He put a lot of responsibility on me. He said 'I'm placing myself in your hands. Don't let me down.' Since that time, he has considered me not only a friend but a very capable special effects person. I find him a fascinating man. Here's an individual, not a studio, but a single solitary man who actually has over \$50 million worth of movies in the works.

"He's a pretty sensible human being when it comes to movie making, too. If you're in a meeting with him and you say 'Okay, if we do this it's going to cost another million dollars,' you'll get an answer. Now, if you did that with a major studio, you'd have to go through dozens of different departments and committees to get an okay. With Dino, he'll



Effects master Frank Van der Veer at work in his California headquarters.

just look at you and ask 'Will it make the movie better?' If you convince him that it won't matter all that much he'll say 'We're no gonna spend the money.' If you convince him that it will make a dramatic improvement, he'll smile and say 'Okay, we spenda the money.' He makes the decision himself, instantly. He's responsible for everything in his movies. He's really a fascinating man to work with. He manipulates events."

Despite the original problems with the film, all concerned with *Flash Gordon* seemed to be positively ebullient about the movie at this stage, and that includes the actors involved, many of whom are making their first foray into science fiction. Veteran British actor Peter Wyngarde finds killer Klytus a really delightful role to sink his teeth into, seeing him as "part prime minister, part general, part politician, part secret policeman. He's just waiting in the wings for the moment to pounce."

Italian actress Mariangela Melato, best known as Italy's answer to the American girl-next-door, is equally enamored with conniving Kala. "Normally I play very nice, very normal women," she remarks. "Kala is cold and cruel, strong and very strange. Near Nazi. It's a very good part for me to explore."

Yet another villain to find her role a plum package is Ornella Muti, who describes the lascivious princess Aura as "a very sexy lady yes, but much more than that. In the beginning of the film she is all animal appetites. For her, everything is linked with desire—the killings, the torture. But she changes and becomes more of a human being." Human, sure, but still nobody's idea of the kind of girl that married dear old dad.

The fact that most of the actors working on *Flash* are openly pleased with the script is a tribute to the producer's sense of organization and determination to get the project off the ground. "It's an interesting script," comments Van Der Veer. "For a while, we had weekly scripts and some of them were really not all that wonderful. They changed drastically from week to week and the one we finally came up with is quite fascinating.

"Flash is a totally interesting character to explore. With someone like Superman, it's difficult for the average kid in the audience to equate himself with the hero. Superman is a super being. Flash is not. Flash is a person who gets involved with exciting other lands. He encounters people who are different, creatures that are different. There's always a contest going on between Flash and the opposition. He is always in jeopardy and has to work his way out of his fixes the way a super athlete would and not a super being. He lives in a fantasy world but it's a fantasy world that kids and everyone can relate to. The ultimate contest is, of course, one of good vs. evil; Flash vs. Ming."

Van Der Veer's estimation of the ultimate contest may be a bit short-sighted. In order to complete the film on time, technicians from half of Europe must cooperate totally to bring the \$40 million epic in on time. "Well, sure," Van Der Veer laughs. "I suppose you could call that our biggest challenge. There is a small communications barrier in the fact that the production designer is Italian and he has his own Italian contingent. Then we also have the British team and the American team. Yet we all realize that we have to work together to pull this movie off. We can't afford to grandstand at all. I really think that all of us believe *Flash Gordon* is the most important film we've ever done."

And so, with a cast and crew from half of Europe united behind a single, spacey cause, *Flash Gordon* speeds towards its December release; openly being touted as *not* just another space fantasy. Producer DeLaurentiis is, of course, doing his best to back up those claims. For instance, in this trip to a distant galaxy, the music of John Williams, John Barry, Jerry Goldsmith and their countless orchestral peers will probably be conspicuously absent. In fact, when Zarkov and his planet-hopping pals take to the stars this year, audiences around the world may be treated to a soundtrack concocted by a gold record award-winning rock troupe currently negotiating with DeLaurentiis.

Talk about spacey!



PHOTO: DOUG GRAMER

**W**ith one foot planted in science fiction and the other solidly in the world of science, Charles Sheffield is particularly well qualified to make the astonishing predictions listed here. Since he began writing science fiction less than four years ago, his short stories have appeared in most of the major SF magazines. At present he has two novels (*Sight of Proteus* and *Web Between the Worlds*) and one short story collection (*Vectors*) in print, with three more novels in the works. In addition, the British-born PhD (theoretical physics) has published more than 50 scientific papers, on subjects ranging from general relativity to large-scale computer systems. He is vice president in charge of research and development for Earth Satellite Corporation, a private concern which analyzes data from Earth resources satellites. In his position as president of the American Astronautical Society, Sheffield organized the conference on "Commercial Operations in Space 1980-2000" scheduled to take place in Washington D.C. March 27-28.

## Ten Surprising Predictions for the Future

By CHARLES SHEFFIELD

**P**redicting the future is not always difficult. There are some developments so obvious that no predictive power is called for in suggesting them. Into this category I place such things as wrist radios, increased emphasis on solar and bio-renewable power, complex "antenna farms" at synchronous orbit, or the development of a fusion reactor.

Much more difficult is the prediction of the *dates* when these things will happen; and most difficult of all, to my mind, is the prediction of events and discoveries that are not yet in the mainstream of public thought and attention—but which will radically affect our lives when they are developed.

The ten items that follow are of this nature. They were produced upon request, for an early-morning talk in Virginia. Looking them over just before I began, I was reminded of the White Queen in *Through The Looking Glass*. She believed as many as six impossible things before breakfast (about four more than my audience, I suspect.) Curiously enough, I believe everything on my list.

Some things that are not included may appear to be obvious oversights—as some of them may be. But others, such as solar power satellites, are omitted not because they will not come, but because their arrival in some form is certain, and well-documented in other sources. The idea of my list is to look at the unexpected and the undocumented, or to set dates on events that have so far been seen only as remote or fictional.

Why?

Only because, if we look back at the major

developments of the last century, we find that most of them came as a complete surprise. Who, apart from a tiny handful of visionaries, expected the computer, the manned and unmanned space program, the telephone, the automobile, television, antibiotics, atomic energy, organ transplants or aircraft?

In other words, next year is always a surprise to us. It is only by looking for the unexpected that we have any hope of predicting our own improbable future. Although a major breakthrough can often be *defined* as one that nobody could have foreseen, the effect of looking far ahead is still worthwhile. If it cannot protect us from future shock, perhaps it can cushion the blow.

*Item 1: Energy from radioactive waste. Our present radioactive wastes will form a useful and harmless energy source, 40 years from now.*

It is best to use an analogy here. When electrons of an atom are in an excited state, and then return to their lowest energy (ground) state, radiation is given off as visible, ultraviolet, or other wavelength light. The particular wavelength emitted depends on the electron transition.

In 1917, Einstein showed that in addition to the natural transition from the excited state to the ground state, there must also be possible a *stimulated* transition, and the result could be termed stimulated emission of radiation. In 1960, this idea was applied in creating the laser (light amplification by stimulated emission of radiation).

Now, what is radioactivity? It occurs when

the *nucleus* of an atom decays from an excited to a ground state. The energy released when this takes place is usually much more than in an electron transition, so the resulting radiation is much shorter in wavelength. Instead of visible or ultraviolet light, we get gamma rays given off. Quite often, the change to the ground state also involves the emission of a particle—an electron, a positron, or an  $\alpha$ -particle.

Suppose that we could produce a *stimulated* transition to the nuclear ground state. Then instead of a material remaining with an excited state of the nucleus (i.e. radioactive) for many years, perhaps even for hundreds or thousands of years, we would be able to extract all that energy of transition in a short time. The energy we will put in should be less than the energy that comes out and the final product will be in its nuclear ground state—with no radioactivity.

We will have solved the radioactive waste problem and have a useful new form of energy production.

Naturally, there are difficulties or we would be doing it today. Although since 1968 theoretical and experimental evidence has been growing to link the weak interaction (governing the emission of electrons and positrons from the nucleus) and the electromagnetic interaction (governing the decay of electrons from excited to ground states), we still have no idea how that relationship might be used. That's why I say 40 years from now, and not 10 or 20.

I am willing to make a more immediate prediction, though. Abdus Salam and Steven Weinberg, who independently evolved the theory that unifies the weak and electromagnetic forces, will win the Nobel Prize for that work within five years.\*

*Item 2: Aging. The mechanics of the aging process will be understood within 15 years. We can look for arrest of aging 10 years after that, and 50 years from now rejuvenation of humans will be conceivable.*

The aging process has been receiving a good deal of attention recently. The questions in this case are mainly *how* and *when*. When we talk of rejuvenation, "conceivable" is used rather than "possible," because there is a good chance that we will not achieve rejuvenation in the foreseeable future, even when we have learned to prevent organisms from aging. It may be possible to freeze the clock, but not to turn it back.

One of the peculiar things about human beings, remarked on long ago, is that we already live far longer than we ought to. In terms of size and metabolic rate, humans might be expected to have a maximum

\*This was written in August, 1979. In October, the Nobel Prize for Physics was awarded to Abdus Salam, Steven Weinberg and Sheldon Glashow for their work in unifying the weak and electromagnetic interactions.

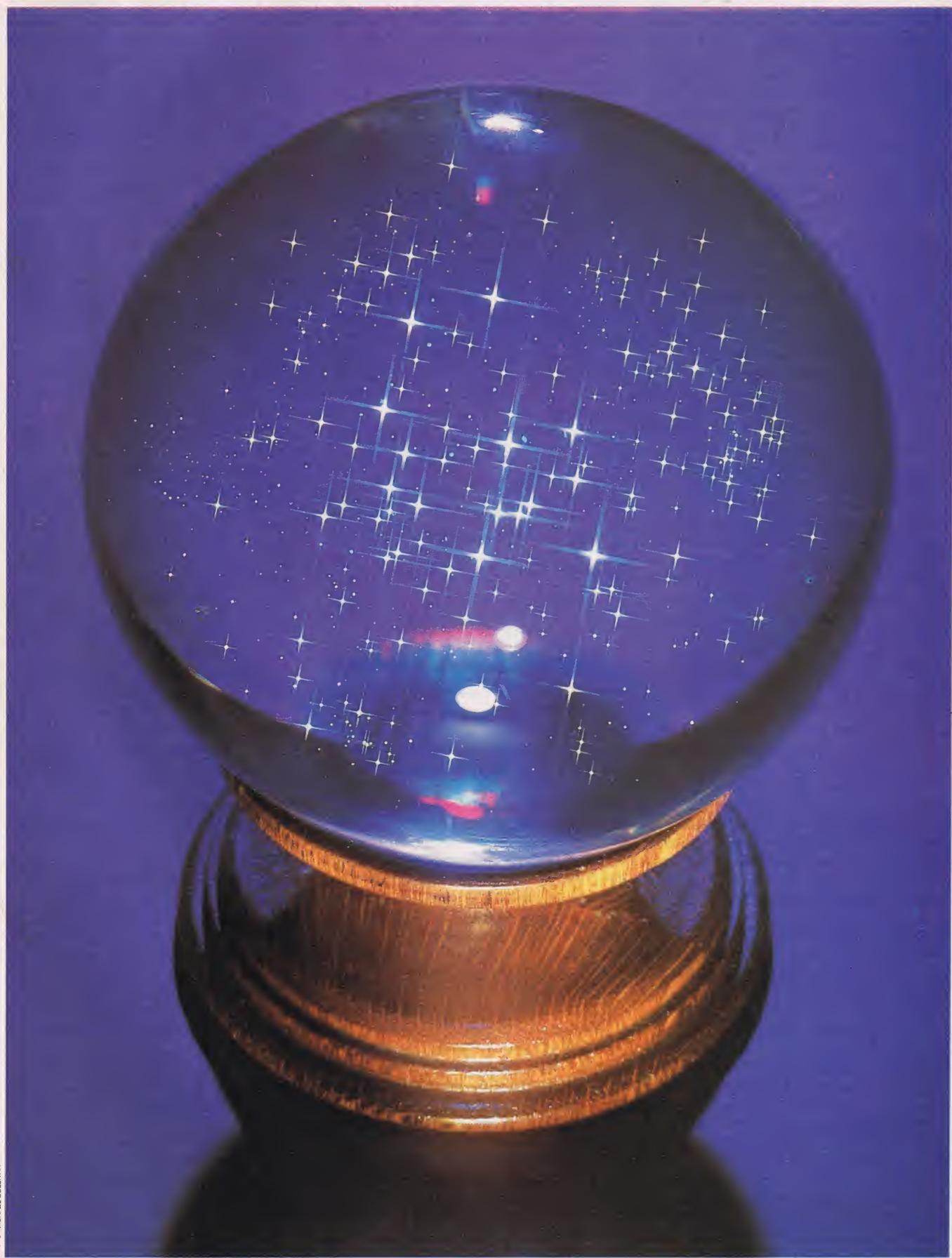


PHOTO MICHAEL SULLIVAN

lifespan potential of about 45 years, instead of the century that we actually enjoy. This increased lifespan correlates well with a relationship between brain weight and body weight, and suggests that our large brains are central to our long lives. This, however, is an observation, and not an explanation. The latter must be developed in biochemical terms.

Our long lives are encouraging mainly because this phenomenon appears to have occurred only in the past few million years. The proof that life *can* be extended is offered by the fact that we *have*, albeit unconsciously, extended it in the recent past.

If the enlarging of the brain was central to our increased life span, we may look to some other increase in intelligence or memory to increase it again. That increase may well come from outside—through the use of computers in complicated bio-feedback modes.

It is also reasonable to ask *how much* we may hope to extend our lives, even if we cannot arrest the aging process completely or reverse it. We have already doubled our span in the past few million years. It is not at all unreasonable to hope to double it again. The social implications of a possible extension of lives to two centuries or more are staggering, particularly since the means for this prolongation may be available only to a few. We will not look at those social aspects here.

Nor will cloning be discussed, but not because it is too difficult—nature does it all the time, when eggs twin before they develop. I believe we will see cloning in the next 20 years for the high level mammals, but I do not regard it as a major development that will profoundly affect the human race.

*Item 3: Synthetic food. We will see rapid progress in the conversion of fossil hydrocarbons to food. Within 30 years we will see the first synthesis of edible products from the basic elements.*

One of the first results of recombinant DNA work will be better bacteria, tuned to accomplish specific chemical transformations. These organisms will be able to start from one point in the hydrocarbon sequence and build up to proteins, fats, and other fully edible end products. We have a flying start on this, thanks to a number of natural bacteria that process fossil hydrocarbons. Oil and gas prospecting already recognizes and uses such organisms.

It should be only a few years after that when we can begin *in situ* conversion of oil shale and tar sands to useful food products. The United States has a huge supply of this form of oil, hard to extract by conventional methods and costly to process. Biological processing may be the answer for both conversion and extraction.

The use of hydrocarbons must be only an intermediate step, since we already know that fossil fuels are in short supply. Production of food from basic elements depends only upon the availability of an abundant source of

energy. Already, we can create hydrocarbons, and build up from the simplest (methane) by “reverse-cracking.” We can get ethane, propane, and then on to the heavier alkanes and alkenes, and finally up to edible substances. The only drawback is the large amount of energy that we need to do it. I assume that we will have abundant energy 30 years from now—from solar energy, from fission plants and from fusion plants. Without abundant energy, everything else in our technological projections will be hindered, slowed or stopped.

*Item 4: Ultra-strong materials. Within 50 years we will have materials that are ten times as strong as anything we can now make.*

This may sound like rather a dull prediction, but it makes possible a number of wild developments. First, let us offer the rationale that leads us to expect stronger materials.

The ultimate strength of any substance depends finally on the strength of the

“200 years hence we will be able to generate gravitational fields... We need this capability before we can undertake light-years-long trips in a reasonable time.”

chemical bond between atoms and molecules. The bond strength in turn depends on the coupling of the outer electrons of the constituent atoms. Inner electrons and the atomic nucleus contribute nothing to the bond strength. The strongest materials, therefore, should be the ones in which all electrons can participate in the coupling. Further, for a low weight, high strength material, we must use light atoms, where the nucleus—which is wasted weight for bonding—weighs as little as possible.

The strongest material we can make at the moment uses dislocation-free graphite whiskers. It is light as well as strong. However, on the basis of chemical bond strengths and atomic weights, we find that a metallic hydrogen fiber will in principle offer a strength-to-weight ratio about nine times as great. We do not yet have any idea how to construct such a fiber, and it will certainly be a big technological challenge to do it.

The most interesting thing about a new ultra-strong material may well be the way that it will transform our ideas on space travel. It will be feasible to construct Skyhooks, continuous load-bearing cables that extend from beyond geosynchronous orbit all the way to the Earth's equator. The result is a Space Elevator, making rockets unnecessary for transporting people and goods to and from

orbit. One can envisage a pollution-free, energy-conserving system, fully reusable and safe. Such a scheme makes the coming space shuttle seem like a primitive rowboat.

I expect that we will see suitable materials developed within 50 years. The first prototype of the Skyhook using these materials will follow within 30 years of that.

*Item 5: The immune reaction. Within 25 years, we will understand and be able to control the immune reaction.*

It is the immune reaction that makes us reject skin grafts from other people, or organ transplants from unrelated donors. At the moment, all we can do is weaken the immune reaction by hitting the body hard with other harmful agents—drugs and radiation, both undesirable.

Once we understand the basic causes better and can control them in non-harmful ways, medical treatments will be transformed for many diseases. If cancer still can't be cured 25 years from now, the impact will be much lessened because any type of implant, from any donor, will be possible. The only incurable diseases will be those that affect the whole organism, or the brain itself. Anything else—liver, lungs, heart, stomach, arms, legs, eyes—can be replaced. The limits will be decided by the skill of the surgeon in matching tissue and nerves from donor to receiver.

Before that time arrives, we may find that another medical treatment gains favor with the wealthy. I have already said that I assume cloning is an inevitable part of the future. A clone of an individual can be made to share the same immune reaction. There is no reason that a wealthy person should not grow a clone of himself or herself and keep it in a dormant condition until spare parts are needed. This will raise arguments which will make current abortion disputes look negligible, particularly if it proves possible to transfer a brain to a complete host cloned body. In such a case, who has been killed?

More complete mastery of the immune reaction will arrive 40 years from now. With it will come more complex merging of human and non-human tissue. The creation of hybrid creatures, however, apart from its great biochemical matching problems, appears rather pointless. Perhaps for recreation? It would be interesting to experience the world through the eyes of a Bengal tiger or a hippopotamus, but I don't see that as part of a very probable future.

We will also need full mastery of the immune reaction and organic/inorganic coupling for our next prediction.

*Item 6: Computer evolution. Within 50 years we will build the first self-replicating computer, within 70 we will build a computer that can be said to have a self-awareness, and in 100 years we will build a computer that is able to analyze its own design and suggest improvements.*

The classical test to decide if a machine can think was proposed in the 1940s by Alan Turing. It sounds simple enough. You are allowed to transmit messages to and receive messages from some entity (you can't see it). If you find with your questions that you are unable to determine whether or not the entity is human, then it can fairly be said to think. Whether it is actually a computer or a human, or even a well-behaved chimpanzee, is irrelevant. If it can pass as a human, it will be considered a thinking being.

It is certainly an interesting test, but there are problems with it. For one thing, we are not told who will be administering the test, and it is debatable as to how many actual humans can think.

I believe that in 30 years we will have computers that can pass the Turing test. They will also be able to converse in natural languages with their creators. Twenty years later, they will be able to build their own facsimiles. To argue that such a process is logically impossible, when we do it ourselves without thinking about it at all, does not seem to be reasonable. The more difficult question, that of self-awareness, cannot really be answered until we can define what we mean by self-awareness. But I believe that a clear definition will be available, and computers that satisfy the definition will exist 70 years from now.

The self-improving computer (Horatio Alger model) is the most difficult of all. A number of writers have suggested that such computers will mean the end of the human species.

I disagree. These computers will be the most valuable invention that we have ever made or will ever make. We will have provided a procedure of *conscious evolution*, our first alternative to random biological evolution. I see nothing illogical or frightening in the concept, and mankind will benefit from the optional evolutionary path. Somewhere along this road I expect that we will see physical links between humans and computers, and after that we will have combined consciousness: human and computer.

We ought not to boggle at the idea. Man and dog have been symbiotically linked for at least half a million years—why not Man and IBM?

*Item 7: Suspended animation. Within 20 years we will be able to slow the human metabolism indefinitely and then revive the subject to normal functioning.*

Already a number of people have been placed in cryogenic storage, with their bodies held at liquid nitrogen temperatures. They died of disease or accident, and they or their relatives hope that the time will come when they can be not only revived, but cured of their fatal condition.

I'm afraid that I consider the chances they will be restored to life quite negligible—not much better than those of Tutankhamen's mummy. We do not know how to freeze and

unfreeze without destroying vital tissues. But as soon as we do (and I think the freezing is the most important stage of the technique) we will have suspended animation, for days or for many years.

I am not sure there is much point to this whole exercise, and it is certainly debatable as to whether or not it should be considered a major step forward. There seem to be only two good reasons for wanting to do it. The first is the natural one, to preserve the life of someone suffering from an illness that is now terminal but should be curable within, say, ten years. The other reason would be to serve as a human "time-capsule." Many things about past eras cannot be transmitted by books, pictures or recordings. Think what it would be like to be able to talk to Julius Caesar, or one of the Pilgrim Fathers. Our ideas of history might be changed radically. Our descendants may have the same urge to talk to one of us.

The subject of suspended animation has

**"Within 50 years we will build the first self-replicating computer, within 70 we will build a computer that can be said to have a self-awareness . . ."**

been treated often in fiction, beginning with H.G. Wells' *When The Sleeper Wakes* or Washington Irving's earlier story of Rip van Winkle. We are approaching the time when it can become a fact.

*Item 8: Subnucleon processes. Within 30 years we will understand the subnucleon world well enough to begin to think of applications. In 75 years we will have the world's first subnucleon reactor, and in 125 years it will be a significant contributor to mankind's energy supply.*

Until 1896, atoms were thought to be indivisible objects. The energy sources available to man until that time were derived from chemical energy, involving only the outer electrons of the atoms. When Henri Becquerel discovered radioactivity, investigation of the subatomic, the nuclear world began. It offers an energy source about a million times as powerful as we can achieve from chemical energy.

Since 1964, we have been getting a first look at the next level down. The idea was proposed in that year, by Gell-Mann and independently by Zweig, that protons, neutrons and other heavy particles are composed of a set of fractionally charged objects, termed "quarks" by Gell-Mann. The proton is no longer thought of as a simple particle, but as a

compound body. No one has ever produced or observed a quark, but the evidence for their existence keeps growing. There is a world within a nucleon—a sub-nucleon structure.

We have no idea how we might use the sub-nucleon world, just as in 1900 no one had any thought of building a fission or fusion reactor. However, quark binding energies for the proton and neutron must be at least a thousand times as strong as the main nucleon-nucleon interaction, currently known as the "strong" interaction. This therefore represents a potential energy source far more condensed than either fission or fusion. In 125 years we will begin to harness it as a standard power source.

*Item 9: Gravity control. 100 years from now we will know how to manipulate gravity; 200 years hence we will be able to generate gravitational fields.*

Analogy is again instructive here, this time with our understanding of magnetism. A thousand years ago, the only magnetism was that occurring naturally, in the natural ferromagnetism of lodestones. We could find magnetic material, but we could not affect the strength of magnetization, nor could we create magnetism.

Michael Faraday's experiments and their theoretical formulation by James Clerk Maxwell in the middle of the last century changed the situation. We can make magnetic fields of any size or strength that we wish, turning them on and off in a split-second.

For gravity, we are still in the pre-Faraday stage. We can observe it, and even measure and use it, but we cannot vary its strength, nor can we create a gravitational field except by accumulating mass.

Einstein's theory of gravity may be the single most profound and beautiful construct of the human mind. Yet it does not point to any easy method of gravity creation or control. Thus I place gravity control at the very end of my 200-year view. New fundamental theories of matter may be needed, to supplement or supplant Einstein's work as his did Newton's.

With any form of gravity control, the physiological effects of accelerated movement are also controllable. Travel in a vehicle whose induced gravity field matches its acceleration will be subjectively indistinguishable from free fall, with no acceleration perceived by the travelers. We need this capability before we can undertake light-years-long trips in a reasonable time.

*Item 10: The fifth force. 120 years from now, we will have evidence of a fifth fundamental force of nature. We will begin to see potential applications 200 years from now.*

At the moment we recognize four fundamental forces: electromagnetic, that controls such phenomena as the emission of light from electrons of atoms; gravity, that controls the

movement of the big pieces of our universe (planets, stars and galaxies); "weak" forces, that govern the process of beta decay of a nucleus and the change of a neutron to a proton, electron and neutrino; and "strong" forces, that hold together the nuclei of atoms.

Two of these forces—the strong and the weak—were discovered only during this century. It is hard to believe that we have now completed the list, and discovered all the basic forces of the universe. In the sub-nucleon world of the quarks, or the superstar world of the quasar, we are likely to find evidence that will make us admit one or more fundamental new forces. They are more likely to be found in very small or very large regions, simply because these are the least well explored.

In the long term, the "fifth force" may play as large a part in human life as electromagnetism or the force of gravity.

\* \* \*

For completeness, two other lists should be added. Those that were omitted because they are in my opinion inevitable and not at all surprising, and those that are excluded because I do not think we will see them in the next 200 years.

The "inevitable" list includes:

- nuclear fusion plants
- solar power satellites
- permanent space stations
- laser propulsion of aircraft
- laser anti-missile systems
- wrist radios, televisions and computers
- a cure for cancer and most other diseases
- tailored bacteria for production of human enzymes
- improved prostheses for human repair
- chemical storage and retrieval for computers
- solar system manned exploration, to Mars and beyond
- fully reusable launch vehicles
- asteroid mining.

At the same time, I don't expect to see these events or discoveries in the next 200 years:

- contact of Earth by extraterrestrial beings
- manned interstellar travel—except on a one-shot, one-way basis
- transfer of human consciousness and memory to a computer or other inorganic storage
- evidence of human extra-sensory perception
- terraforming of Mars, Venus, or other planet or satellites of the solar system (this does not preclude colonization)
- an end to new fundamental discoveries in science

The last one is the most important of all. Two hundred years from now, I expect the universe to appear as complex, wonderful and incomprehensible as ever. The features that puzzle us will be different, but they will be no less numerous. It will still be possible for the greatest scientist of his day, reflecting on his work, to look back over the achievements of a hugely productive life and echo, two centuries hence, the words of Newton, two and a half centuries ago: "I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me."

**F**

# next issue



## EMPIRE ART

In 1978, 20th Century-Fox unveiled *Star Wars*... the most popular film in Hollywood history. Now, two years later, comes the long-awaited sequel film *The Empire Strikes Back*. Once again, artist Ralph McQuarrie has designed many of the spacier elements used in the movie by Luke Skywalker, Han Solo and the take-an-alien-to-lunch-bunch. FUTURE LIFE will offer a colorful portfolio of Ralph McQuarrie's out-of-this-world pre-production paintings for this new SF epic.



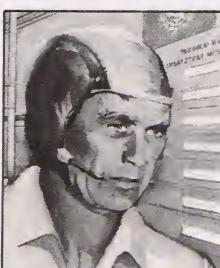
## LIGHTS, CAMERA... NUCLEAR DISASTER

Around the world, newspaper headlines are announcing the coming of the Second Cold War. If history does indeed repeat itself and the threat of nuclear war hangs heavy over the heads of the global population, you can bet that Hollywood will delve into its bag of prophetic scare tactics once again. Thirty years ago, a spate of nuclear disaster films began a trend that was destined to continue for over two decades. *On the Beach*, *Dr. Strangelove*, *The Bed-Sitting Room*, *Five*. Next issue, FUTURE LIFE takes a look at the history of nuclear catastrophes in the cinema.



## GIFTS OF RECOMBINANT DNA

A new scientific industrial revolution is underway. By transferring DNA into *E. coli*, scientists have already been able to produce large quantities of substances that have heretofore been extremely rare and expensive. Human insulin, human growth hormone and now human interferon—a natural virus-fighting substance—have been made in the laboratory through the technology of gene-splicing. Industry is gearing up for a biological boom sparked by recombinant DNA techniques. What will the next fruits of the genetic engineering revolution be and what will they mean to you?



## SPACE INTERNATIONAL

With the space shuttle stalled, we've heard plenty of reassuring talk about "maintaining U.S. leadership in space." But the truth is that international activity is looming on every horizon. The Soviet space program has the highest profile, of course, with the recent string of long-duration manned missions. But not far behind are the French, the Japanese, the West Germans and even the Chinese. How will international cooperation—or competition—shape the future off-planet? Decide for yourself when you read about everybody else's space programs.

## PLUS

A behind-the-scenes look at the epic science film *The Search for Solutions*, soon to be aired on PBS... Future Forum asks SF writers Larry Niven, James P. Hogan, Charles Sheffield, Richard Lupoff, Joan Vinge, Roger Zelazny and more for their opinions on the lack of citizen interest in U.S. space efforts... Still waiting for perfect 3D television and movies? FUTURE LIFE reports on recent developments in three-dimensional photography... Norman Spinrad offers speculations on the technology of altering your consciousness in the Tomorrow column... Colorful space art by Morris Scott Dollens will be spotlighted in Portfolio... plus Databank news and new book reviews.

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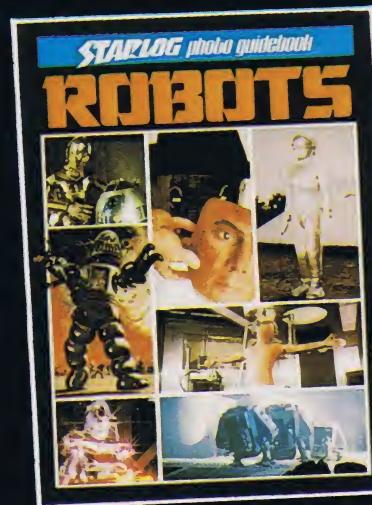
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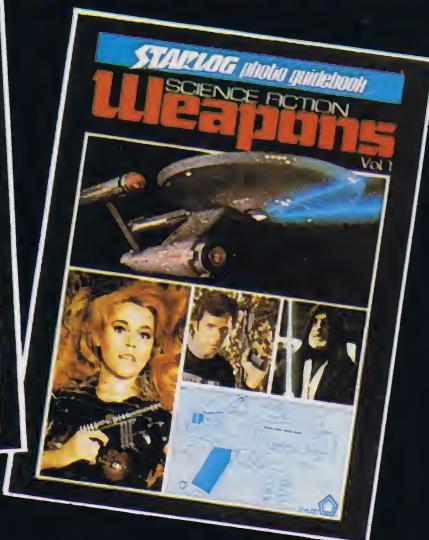
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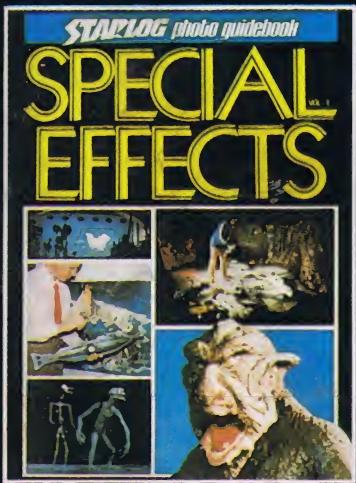
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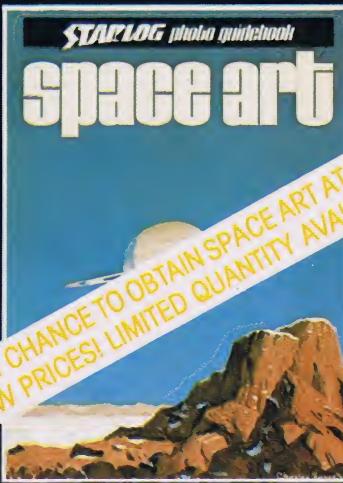
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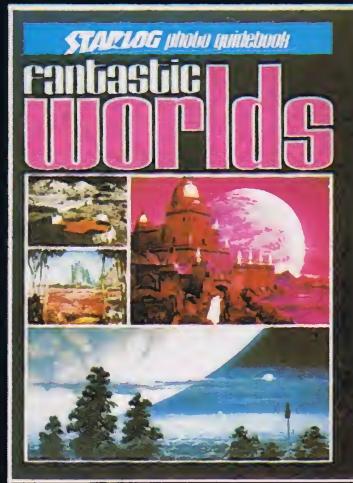
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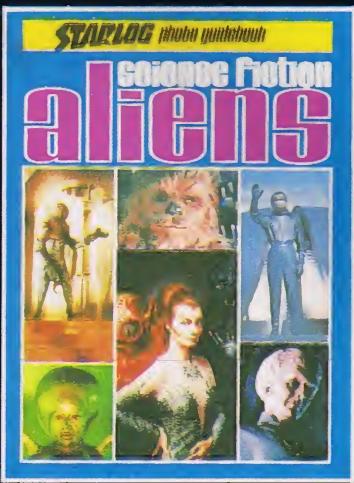
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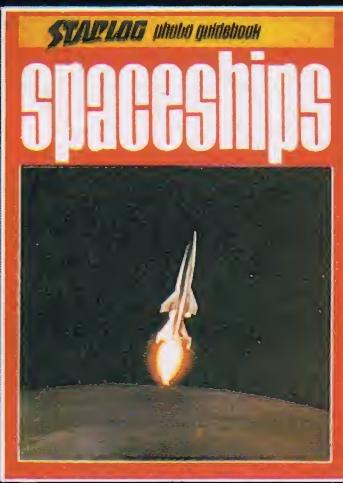
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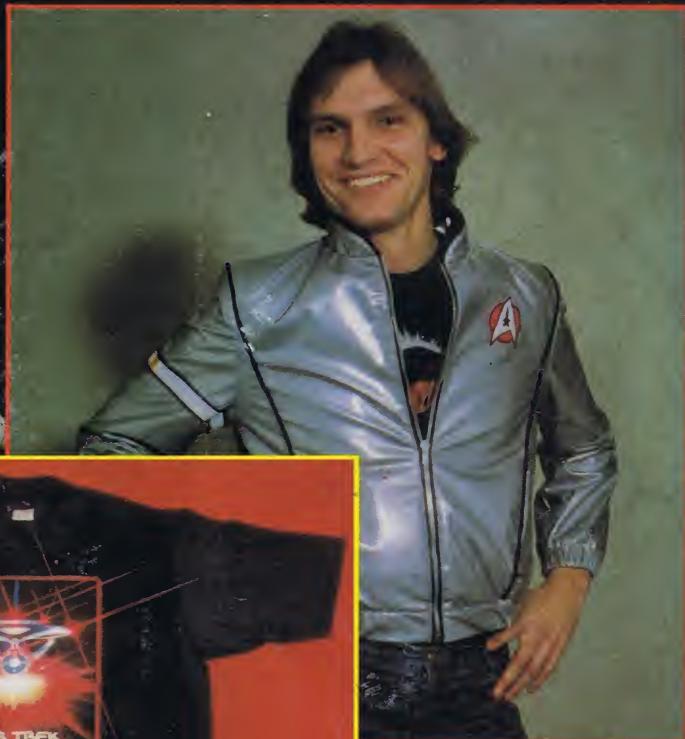
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